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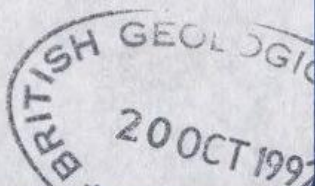
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An annotated bibliography
Of Ecuadorian geology

C.R. BRISTOW

Overseas Geology and Mineral Resources

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Note: This text has been modified. The late entries have been indexed, and different numbers have been assigned to each reference. Also, the bibliography has been adapted to a Microsoft Excel sheet. The original text can be found in the following link: (Bristow, 1981)

Quito, September 18, 2021.

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An annotated bibliography of Ecuadorian geology

C.R. BRISTOW

Information on the geology of Ecuador is varied and scattered throughout dozens of journals, many of which are obscure and difficult to obtain. Additionally, there is an abundance of unpublished material in the archives of the various oil and mining companies, the Dirección General de Geología y Minas (DGGH), Quito, and the Dirección General de Hidrocarburos (DGH), Quito.

To date there have only been four bibliographies dealing specifically with the geology of Ecuador (23, 221, 497, 792). Several publications on Ecuador have included extensive lists of references (149, 188, 431), and there are a few specialist bibliographies (396, 427, 832, 879, 880), together with lists of the holdings of the largely unpublished material at the DGGM and DGH (52, 56).

Much of the older geological literature stems from the golden age of exploration and includes accounts by Darwin, Humboldt, Orton, Reiss, Spruce, Stübel and Whymper. One problem with source material on Ecuadorian geology is that much of the work was carried out by private concerns, particularly the oil companies. Arising out of their explorations is a wealth of stratigraphic and palaeontological data contained in company reports. Some of this information, particularly that of coastal Ecuador, although no longer confidential still rests in not easily accessible reports. Notable exceptions are the works by Canfield (1966) who drew heavily on unpublished documents of the coastal area, Colman (1970) who put forward his company's most important theory of the olistostromic nature of the geology of the Santa Elena peninsula, and Tschopp (1953) whose work is still the only readily available detailed account of the Oriente Basin. Hoffstetter (1956) and later Bristow and Hoffstetter (1977) in their stratigraphic lexicon of the country, also included many references to unpublished material since this was commonly where new stratal terminology was first introduced.

In recent years there have been a number of technical aid missions to the country, of which the work by the UN, primarily on mineral exploration, has resulted in a number of important, but not widely distributed or publicised, reports. Work by the French, and in particular the Institut Français du Pétrole, added an enormous amount of detail to the micropaleontology of the Coastal, Andean and Oriente regions of Ecuador. Unfortunately, with one exception (295), the fossils were not illustrated, and all the reports were of a very restricted distribution, although they were, in general, not confidential.

It was the French who were responsible for the compilation of the first, fairly detailed geological map of the country at a scale of 1:1000000 (1969). They also initiated systematic regional mapping of the coast of which the first two published sheets, at a scale of 1:100000 appeared in 1970.

British Technical Aid, in conjunction with the DGGM, commenced with a photogeological survey of the Loja Province in 1969 (Kennerley, 1973). In 1972 this programme was expanded when a 3-man British team and their Ecuadorian counterparts began systematic regional mapping in the Andes at a scale of 1:50000 and publishing the results at 1:100000. This work slowly expanded and continued until 1980, so that a substantial part of the coastal belt and the Andes has been systematically mapped (Figure 1). The importance of the work is that it now allows much of the earlier geological accounts to be placed in its correct regional setting.

Books on Ecuadorian geology are few. The earliest was Wolf's (1892) classic 'Geografía y Geología del Ecuador', but it was not until Sauer's (1965) account, in Spanish, on the geology of Ecuador, that there was a readily available text book within the country. This work was unfortunately only partially revised when translated into German (Sauer and Putzer, 1971). Sheppard (1937) for a long time remained an important source for the geology of the Santa Elena area. Canfield's (1966) compilation, which appeared in both English and Spanish, is still the only readily available source for information on the Manabí and Esmeraldas areas. Hoffstetter's (1956) Lexicon was a very important work as it included much previously unpublished material. This Lexicon has now been completely revised (Bristow and Hoffstetter, 1977) and incorporates a wealth of new stratigraphic, palaeontologic and radiometric data, and for the moment it is the most up-to-date account of the geology of the whole country.

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Many people have assisted in the compilation of this bibliography. Of outstanding help were Miss Sylvia Brackell and Mr. David Bate of the Library of the Institute of Geological Sciences, London, who tracked down many of the more obscure publications and were able to answer most of my questions concerning the hard core of 'difficult' references. Dr. Whittaker and Mr. P. Nuttall, both of the British Museum (Natural History), London, spent much time checking out several of the palaeontological papers. Mr R. Mansfield kindly supplied a list of titles on the speleology of Ecuador. The late J.B. Kennerley, former team leader of the British Technical Aid geological programme in Ecuador, and Dr. J.W. Baldock his successor were able to clarify certain points on the bibliographical material held in the DGGM and DGH. The latter has made available a map showing the state of mapping in Ecuador, on which Figure 1 is based.

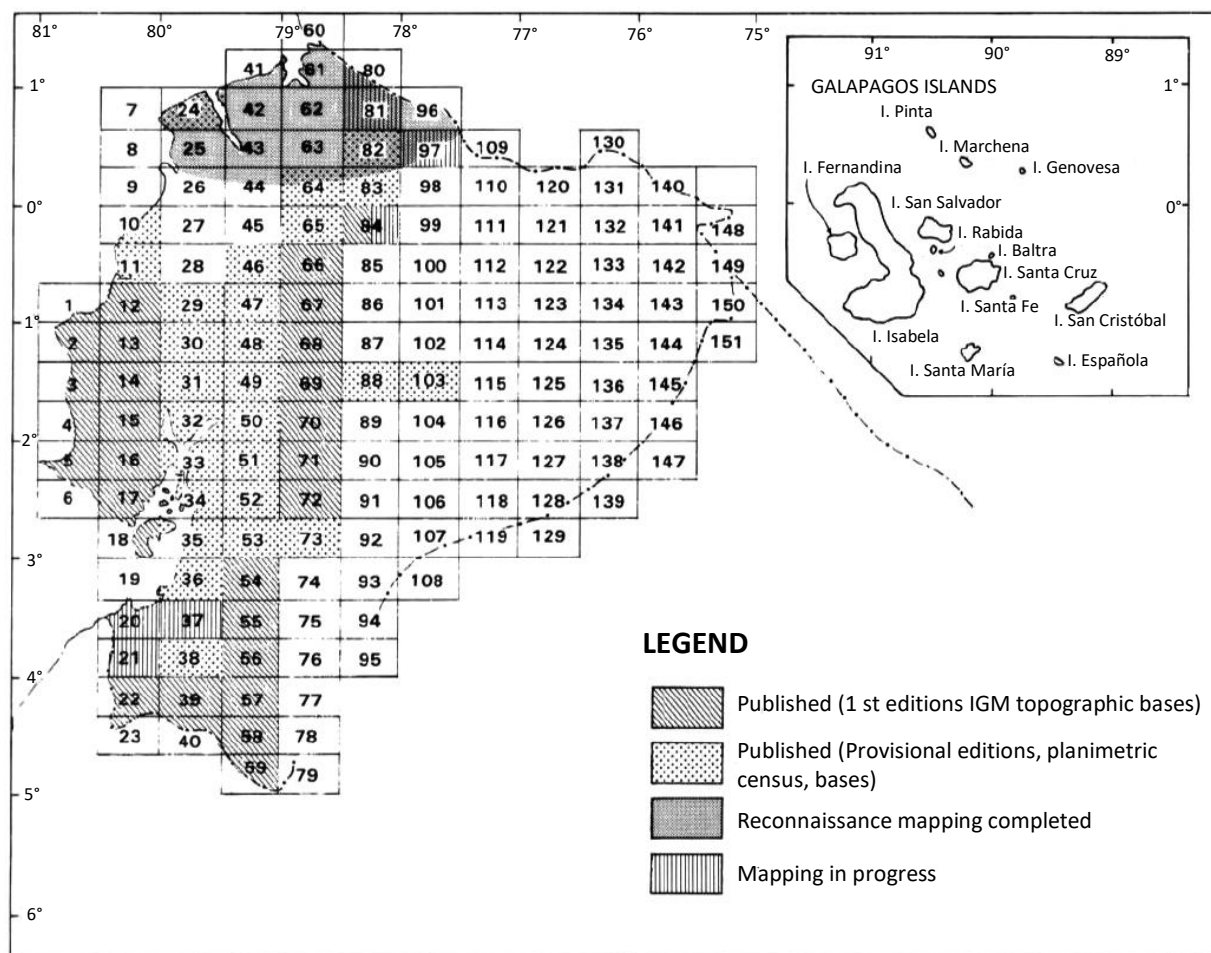


Figure 1 Key to the geological maps of Ecuador (1:100000)

BIBLIOGRAPHY

A

1. ABICH H. (1841) Über die Nature und den Zusammenhang der vulkanischen Bildungen. [Concerning the nature and the relationship of volcanic formations]. (Braunschweig: Vieweg).
2. ABAD C. D. (1977) Algunas relaciones entre la geomorfología y la vegetación en la región morfo-climática ecuatorial. [Some relationships between the geomorphology and vegetation in the equatorial morphoclimatic region]. *Not. Geomorfol.*, Vol. 17, No. 34, pp. 85-94.
3. ACHARYA H. K. (1965) Seismicity of the Galápagos Islands and vicinity. *Bull. Seismol. Soc. Am.*, Vol. 55, No. 3, pp. 609-617.
4. ACOSTA ARTEAGA C. E. (1978) El graben interandino Colombo-Ecuadoriano (fosa tectónica del Cauca-Patía y del Corredor Andino-Ecuadoriano). [The inter-Andean Ecuadorian-Colombian graben (the Cauca-Patía tectonic rift and the Andean-Ecuadorian corridor)]. *Bol. Geol. Fac. Petról. Univ. Ind. Santander.*, Vol. 12, No. 26, pp. 63-199.
5. ACOSTA-SOLIS M. (1971) Lucha contra la sequía y la erosión en la Mitad del Mundo. [Fight against drought and erosion at the Mitad del Mundo]. *Bol. Inf. Cient. Nac., Quito*, Vol. 12, pp. 5-110.
6. ACOSTA-SOLIS M. (1976) *Investigadores de la geografía y la naturaleza de América tropical: viajeros cronistas e investigadores con especial referencia al Ecuador; Parte 1.* [Geographers and naturalists in the tropical regions of America: chroniclers and investigators with special reference to Ecuador, Part 1] (Quito: Instituto Panamericano de Geografía e Historia).
7. AGASSIZ A. (1892) General sketch on the expedition of the Albatross from February to May, 1891. *Bull. Mus. Comp. Zool. Harvard*, Vol. 23, pp. 1-89.
8. AGASSIZ A. (1906) Reports on the scientific results of the expedition to the eastern tropical Pacific. *Mem. Mus. Comp. Zool. Harvard*, Vol. 33, No. 13. 75pp.
9. AGUILAR F.C.S.J. (1868a) Memoria sobre las oscilaciones de la brújula en Quito consideradas en su relación con los temblores de tierra y seguidas en su marcha paralela con las fluctuaciones del barómetro. [Mémor on the compass oscillations in Quito considered in relation to earth tremors and followed by parallel barometric fluctuations]. *Bol. Meteorol., Quito*.
10. AGUILAR F.C.S.J. (1868b) *Memoria histórica y científica sobre el volcán Pichincha seguida de la relación de un viaje a su cráter.* [Historical and scientific memoir of the Pichincha volcano after a journey to its crater]. (Quito).
11. AGUILERA E. (1973) Geología del cuadrángulo de Delicias-Olón. [Geology of the Delicias-Olón quadrangle]. Unpublished thesis, Universidad Central, Quito, Ecuador.
12. ALBÁN M.E. (1937) La radioactividad de las aguas minerales en el Ecuador. [The radioactivity of mineral waters in Ecuador]. *An. Univ. Cent., Ecuador*, Vol. 58, pp. 519-552.
13. ALDRICH L. T. (1977) An onshore-offshore geophysical study of southern Colombia and Ecuador. Pp. 9-15 in *Nariño; Proyecto cooperativo internacional, 1973; la transición océano-continente en el suroeste de Colombia*. RAMÍREZ J.E. and ALDRICH L.T. (Editors) (Bogotá: Instituto Geofísico, Universidad Javeriana).
14. ALETAN G. (1968) Microscopic investigations of various silver-bearing ore specimens of Ecuador. Unpublished report for the U.N. Development Programme, Quito.
15. ALVARADO R. (1967) Estudios geológicos de una cuenca sedimentaria de los carbones del austro, Loja, Ecuador. [Geological studies of a sedimentary basin of the coals of the south, Loja, Ecuador]. Unpublished thesis, Escuela Politécnica del Litoral, Guayaquil. [The stratigraphy in this thesis was adopted in 648 and 904, but see 479 and 149].
16. ANDERSON R. N., CLAGUE D. A., KLITGORD K. D., MARSHALL M., and NISHIMORI R. K. (1975) Magnetic and petrologic variation along the Galápagos spreading center and their relation to the Galápagos melting anomaly. *Bull. Geol. Soc. Am.*, Vol. 86, pp. 683-694.
17. ANDERSON S.M. (1945) Minerals review of Latin America, 1939-1944. *Foreign Miner. Surv.*, Vol. 2, No. 4. [Ecuador, pp. 63-67].
18. ANDERSON S.M. (1948) Review of the mineral industries of Latin America. *Econ. Geol.*, Vol. 43, No. 3, pp. 226-231.
19. ANDERSON S.M. and BROWN L.R. Jr. (1966) The mineral industry of Ecuador. *Miner. Yearb.*, Vol. 4. [Ecuador, pp. 291-298]
20. ANDRADE C. D. (1917) Outline of the petroleum resources of Ecuador. *Proc. 2nd Panam. Sci. Congr.*, Vol. 3, pp. 203-206.
21. ANDRADE M. DE J. (1911) *Las minas de Zaruma* [The mines of Zaruma]. (Quito).
22. ANDRADE M. L. (1936) *Llanganati, viaje a las misteriosas montañas de Llanganati*. [Voyage to the mysterious mountains of Llanganati]. (Quito: Impresor Mercantil).
23. ANDRADE M. J. (1937) *Historia del territorio ecuatoriano a la luz de la paleontología y de la estratigrafía, 1ª parte*. [History of Ecuadorian territory in the light of palaeontology and stratigraphy, 1st part]. Vol. 2, No. 6, pp. 7-31. (Quito).
24. ANDRADE M. J. (1944a) Explicaciones sobre los recientes fenómenos volcánicos. [Explanations of recent volcanic phenomena]. *Gac. Munic. Quito*, Vol. 29, 6 Dec., 1944, pp. 85-96.
25. ANDRADE M. J. (1944b) La búsqueda del Reventador y el hallazgo de Oyacachi. [The search for Reventador and the discovery of Oyacachi]. *Gac. Munic. Quito*, Vol. 29, 6 Dec., 1944, pp. 97-102.
26. ANON. (1893) The gold fields at Playa de Oro, Ecuador. *Eng. Min. J.*, Vol. 55, pp. 25-26, 30-31, 49.
27. ANON. (1900) Mineral resources Ecuador. *Sci. Am. Suppl.*, Vol. 49, pp. 204-222.
28. ANON. (1902) Gold mining in Ecuador. *Eng. Min., J.*, Vol. 73, p. 179.
29. ANON. (1903) Le Mastodon du Chimborazo. [The Mastodon of Chimborazo]. *Cosmos, Paris*, Vol. 48, No. 936, pp. 6-9. [See 427, for a synthesis of all the known Ecuadorian Pleistocene mammals].
30. ANON. (1906) Análisis de las aguas de Tesalia. [Analysis of the waters of Tesalia]. *An. Univ. Cent., Quito*, Vol. 22, pp. 94-98, 187-190.
31. ANON. (1911) The gold mining industry of Ecuador. *Min. J. Phoenix*, Vol. 93, pp. 411-412 [Abstract appears as 32].
32. ANON. (1912) The gold mining industry of Ecuador. *Min. Eng. World*, Vol. 37, pp. 1195-1196. [An abstract of 31 giving a resumé of the possibilities for finding commercial quantities of gold in the Esmeraldas Province].

33. ANON. (1913) Coal resources of the World. *XII Int. Geol. Congr.*, Vol. 1. [Ecuador, p. lxxi]
34. ANON. (1914) Development of mining in South America. *Min. Eng. World*, Vol. 41, pp. 512-533. [Ecuador, p. 533. *A brief account of the gold in Esmeraldas; processing plant at Zaruma, and salt mining at Payana*.]
35. ANON. (1929) The oil fields of Ecuador. *Pet. Times*, Vol. 20, pp. 409-411.
36. ANON. (1932) Manganese in Ecuador. *Eng. Min. J.*, Vol. 133, p. 511
37. ANON. (1935) Le Pétrole en Equateur. [Petroleum in Ecuador]. *Rev. Pét.*, No. 647, pp. 1143-1144.
38. ANON. (1935) Nachrichtendienst über vulkanische Ereignisse 1934. [Information about volcanic events 1934]. *Z. Vulkanol.*, Vol. 16. [Sangay, p. 127].
39. ANON. (1936) Nachrichtendienst über vulkanische Ereignisse 1934-1935. [Information about volcanic events 1934-1935]. *Z. Vulkanol.*, Vol. 16. [Tungurahua, p. 264].
40. ANON. (1937a) Nachrichtendienst über vulkanische Ereignisse 1935-1936. [Information about volcanic events 1935-1936]. *Z. Vulkanol.*, Vol. 17, pp. 186-197 [Galápagos, p. 186].
41. ANON. (1937b) Nachrichtendienst über vulkanische Ereignisse 1936-1937. [Information about volcanic events 1936-1937]. *Z. Vulkanol.*, Vol. 17, pp. 285-296 [Ecuador, p. 286].
42. ANON. (1938) Manganese in Ecuador. *Z. Prakt. Geol.*, Vol. 46, p. 93
43. ANON. (1939) Development along the South American oil belt. *World Pet.*, Vol. 10, No. 6, pp. 90-95. [Ecuador, p. 93]
44. ANON. (1941) Untitled geological map of the Manabí Province. Unpublished map of the Ecua petrol Co.
45. ANON. (1946) *Economic controls and commercial policy in Ecuador*. (Washington: U.S. Tariff Commission).
46. ANON. (1947) *La minería y el petróleo en el Ecuador, enero 1946-marzo 1947*. [Mining and petroleum in Ecuador, January 1946-March 1947]. (Quito, Dirección General Ministerio de Petróleo.)
47. ANON. (1959) *Breve historia de los principales terremotos en la República del Ecuador*. [Brief history of the principal earthquakes in the Republic of Ecuador]. (Quito: Observatorio Astronómico Ministerio de Educación Pública.
48. ANON. (1959) Mapa sísmico y tectónico del Ecuador (1:1000000) [Seismic and tectonic map of Ecuador (1:1000000)]. Comité del Año Geofísico Internacional del Ecuador. [A memoir accompanies the map]
49. ANON. (1966) Lignite exploitability analysis Cuenca-Biblián and Loja-Malacatos Basins. Report of the Pierce Management Corp., Scranton, Pennsylvania. [See also 110, 590, 591, 648, 680, 681, 722, 804, 904, 982].
50. ANON. (1968a) Nouvelles des Galápagos. [News of the Galápagos]. *Not. Galápagos*, Vol. 12, pp. 3-7.
51. ANON. (1968b) New discoveries broaden oil outlook in Ecuador. *World Oil*, April, p. 106.
52. ANON. (1968c) *Índice de recursos naturales (Ecuador)*. [Index of natural resources (Ecuador)]. (Quito: Junta Nacional de Planificación y Coordinación Económica). [Very useful bibliography, including much unpublished material, held by the Dirección General de Geología y Minas, and the Dirección General de Hidrocarburos, Quito – see also 56].
53. ANON. (1969a) Ecuadorean copper prospecting. *Min. J., London*, Vol. 273, No. 7002, p. 393
54. ANON. (1969b) Mining in Latin America. *Econ. Bull. Lat. Am., U. N.*, Vol. 14, No. 2, pp. 78-109.
55. ANON. (1970a) Geología del Ecuador. Comentarios del mapa geológico del Ecuador a escala 1:1000000 – edición 1969. [Geology of Ecuador. Commentaries on the geological map of Ecuador, 1:1000000 scale – 1969 edition]. Provisional document of the Instituto Francés del Petróleo, (Quito: Servicio Nacional de Geología y Minas).
56. ANON. (1970b) Yacimientos minerales y de hidrocarburos. Bibliografía, tablas de ubicación geográfica, características geológicas y mineralógicas principales. [Mineral and hydrocarbon deposits. Bibliography, tables of geographical location, geological and principal mineralogical characteristics]. *Bol. Serv. Nac. Geol. Minas*, No. 2. [Very useful bibliography, including much unpublished material, held by the Dirección General de Geología y Minas, and the Dirección General de Hidrocarburos, Quito – see also 52.]
57. ANON. (1972) Este mes en la industria. [This month in the industry]. *Pet. Petroquím. Int.*, Vol. 30, No. 4, p. 5.
58. ANON. (1973a) Evalúan importancia de hallazgos en Venezuela y Ecuador. [Evaluation of the importance of discoveries in Venezuela and Ecuador]. *Pet. Petroquím. Int.*, Vol. 31, No. 2, p. 4.
59. ANON. (1973b) Ecuador: tres sucesos en Oriente. [Ecuador: three successes in the Oriente]. *Pet. Petroquím. Int.*, Vol. 31, No. 4, p. 5.
60. ANON. (1974a) Ecuador mining development law. *Miner. Trade Notes*, Vol. 71, pp. 7-26.
61. ANON. (1974b) Investigation of volcanic activity in Ecuador. *News. Int. Assoc. Volcanol. Chem. Earth Inter.*, Vol. 11, pp. 14-15.
62. ANON. (1974c) Groundwater resources of the Santa Elena Península, Ecuador. *Hydrotechnics*. 237 pp. [Spanish summary]
63. ANON. (1974d) L'énigme de l'Homme de l'Equateur. [The enigma of Man in Ecuador]. *Sci. Vie*, Vol. 25, No. 676, p. 59.
64. ANON. (1976) UN search for silver in the Ecuadorean Andes. *North Miner.*, Vol. 62, No. 34, p. 5.
65. ANON. (1978) Equateur un besoin urgent de nouvelles réserves de pétrole. *Pet. Econ.*, Vol. 45, No. 10, pp. 304-306.
66. ANON. (1978a) Three fields placed on production in Ecuador. *Oil Gas J.*, Vol. 76, No. 28, p. 46.
67. ANON. (1978b) Eruption impending. *Geotimes*, Vol. 23, No. 10, pp. 30-31. [A brief account of Cotopaxi – see also 610]
68. ANON. (1979) CEEA control exploration. *Min. J. London*, No. 293, p. 503. [CEEA = Atomic Energy Authority of Ecuador].
69. ANON. (1979) Exploration briefs. *Min. Act. Dig.*, Vol. 5, No. 12, pp. 4-5. [Ecuador, p. 4].
70. ANON. (1980) Buenos Aires. *Petromin. Asia, Singapore*. July, p. 18. [Despite the title, part of the report concerns Ecuador's oil industry]
71. ANON. (1980) Ecuador find for Texaco. *Int. Pet. Times*, Vol. 84 No. 2126, p. 6.

72. ANON. (1980) Ecuador. *Rev. Bank. London S. Afr.*, Vol. 14, pp. 199-201.
 73. ANON. (1980) Seismic events: offshore uplift, Cabo Pasado, Ecuador (0.4°S, 80.5°W). *S.E.A.N. Bull.*, Washington D.C., Vol. 5, No. 2, p. 8.
 74. ANTHONY H. E. (1922) A new fossil rodent from Ecuador. *Am. Mus. Novit.*, No. 35, 4 pp. [See also 147 and 434; 427]
 75. ANTHONY H. E. (1925) Introduction. pp. 313-327 in The Punín Calvarium. SULLIVAN L.R. and HELLMAN M. *Anthropol. Pap. Am. Mus. Nat. Hist.*, Vol. 23. [See also 427 for a synthesis of all the known Ecuadorian Pleistocene mammals]
 76. ARAUZ J. (1950) Nueva historia de los Mastodontes ecuatorianos. [New history of the Ecuadorian Mastodons]. *Bol. Inf. Cient. Nac., Quito*, Vol. 3, No. 26-27, pp. 419-425.
 77. ARNOLD R. (1916) Conservation of the oil and gas resources of the Americas. Part 2. *Econ. Geol.*, Vol. 11, pp. 299-326. [Ecuador, p. 309]; *Proc. 2nd Panam. Sci. Congr.*, Washington, 1917, Vol. 3, pp. 201-237.
 78. ARTOPÉ G. (1872) Über augithaltige Trachyte der Anden (G. Roses Trachyte IV. Abt.). [Concerning augite trachytes in the Andes]. Inaugural dissertation, University of Gottingen.
 79. AUDLEY-CHARLES M. G. (1965) Gravity slide deposits in Timor and Ecuador. *Geol. Mag.*, Vol. 102, pp. 560-561. [See also 209].
 80. AUBERT DE LA RÜE E. (1948) Contribution à la connaissance géologique du socle cristallin des Andes de l'Equateur. [Contribution to the geological understanding of the crystalline basement of the Ecuadorian Andes]. *Bull. Mus. Natl. Hist. Paris*, Ser. 2m Vol. 20, pp. 214-216.
 81. AZAD J. (1964) The Santa Elena Peninsula (Ecuador), a review of the geology and prospects. *Rep. Anglo Ecuadorian Oilfields Ltd.*, No. J. A. 7. [Unpublished]. [An important paper in which the olistostromic theory, to account for the complex geology of the Santa Elena Peninsula, is first proposed].
 82. AZAD J. (1968a) Geology and petroleum prospects of the Progreso Basin. *Rep. Anglo Ecuadorian Oilfields Ltd.*, No. J. A. 9. [Unpublished]. [A much more detailed account of the olistostromic theory proposed in 81. Much of the report is published as 209].
 83. AZAD J. (1968b) Geology and petroleum prospects of the Santa Elena Peninsula. *Rep. Anglo Ecuadorian Oilfields Ltd.*, No. J. A. 10. [Unpublished]. [The account of the olistostromes is basically as in 82 – see also 209].
 84. AYON J. H. (1976) *Sedimentología en El Guasmo, Guayaquil*. [Sedimentology in El Guasmo, Guayaquil]. (Guayaquil: Instituto Oceanográfico Armada)
- B**
85. BAILEY K. (1976) Potassium-Argon ages from the Galápagos Islands. *Sci., New York*, Vol. 192, pp. 465-467.
 86. BAIN H. and READ T. T. (1934) *Ores and industry in South America*. Council on Foreign Relations. (New York and London: Harper and Brothers).
 87. BAITIS H. W. and SWANSON F. J. (1976) Ocean rise-like basalts within the Galápagos Archipelago. *Nature, London*, Vol. 259, pp. 195-197.
 88. BALAZS D. (1974) The Jumandi Caves of Ecuador. *Guacharo*, Vol. 7, No. 1, pp. 51-53. Reprint from *Natl. Speleol. Soc. Am. News*, 1972, Vol. 30, pp. 70-72.
 89. BALAZS D. (1975) Lava tubes on the Galápagos Islands. *Bull. Natl. Speleol. Soc. Am.*, Vol. 37, No. 1, pp. 1-4.
 90. BALDRY R. A. (1932) The Clay Pebble Bed of Ancon, Ecuador. *Geol. Mag.*, Vol. 69, pp. 45-46. [This paper needs now to be read in the light of 209 – see also 154, 155, 178, 536, 774, 778, 800, 806].
 91. BANDELLIER A. F. (1906) Traditions of Precolombian earthquakes and volcanic eruptions in western South America. *Am. Anthropol.*, No. 8, pp. 47-81.
 92. BANFIELD A. F., ST. CLAIR D. and BEHRE C. H. Jr (1953) Geology of Isabela (Albemarle) Island, Archipiélago de Colón (Galápagos). [Abstract]. *Bull. Geol. Soc. Am.*, Vol. 64, No. 12, Pt. 2, p. 1392.
 93. BANFIELD A. F., BEHRE C. H. Jr and ST. CLAIR D. (1956) Geology of Isabela (Albemarle) Island, Archipiélago de Colón (Galápagos). *Bull. Geol. Soc. Am.*, Vol. 67, pp. 215-234.
 94. BANNER F. T. and BLOW W. H. (1967) The origin, evolution, and taxonomy of the foraminiferal genus *Pulleniatina* Cushman, 1927. *Micropaleontol.*, Vol. 13, No. 2, pp. 133-162. [Ecuador pp. 139-140].
 95. BARAGWANATH J. G. (1912) Notes on the geology of the Zaruma Mines, Ecuador. *Columb. Univ., Sch. Mines*, Vol. 33, No. 2, pp. 161-165.
 96. BARAZANGI M. and DORMAN J. (1969) World seismicity maps compiled from ESSA, coast and geodetic survey epicenter data 1961-1967. *Bull. Seismol. Soc. Am.*, Vol. 59, No. 1., pp. 369-380.
 97. BARKER R. W. (1932a) Three species of larger Tertiary foraminifera from SW Ecuador. *Geol. Mag.*, Vol. 69, pp. 277-281.
 98. BARKER R. W. (1932b) Larger foraminifera from the Eocene of Santa Elena Peninsula, Ecuador. *Geol. Mag.*, Vol. 69, pp. 302-310.
 99. BARKER R. W. (1933) Notes on the Tablazo faunas of SW Ecuador. *Geol. Mag.*, Vol. 70, pp. 84-90. [First detailed account of the Tablazo fauna – see also 418 and 419].
 100. BARKER R. W. (1937) Geology of Ecuador. *Geol. Mag.*, Vol. 74, pp. 478-480.
 101. BAUR G. (1891) On the origin of the Galápagos Islands. *Am. Nat.*, Vol. 25, pp. 217-229; 307-326.
 102. BAUR G. (1892) Ein Besuch der Galápagos Inseln. [A visit to the Galápagos Islands]. *Biol. Zentralbl.*, Vol. 12, pp. 221-250.
 103. BAUR G. (1897) New observations on the origin of the Galápagos Islands, with remarks on the geological age of the Pacific Ocean. *Am. Nat.*, Vol. 31, pp. 661-680; 846-896.
 104. BECKINSALE R. D. (1976) K-Ar age determinations on samples from Ecuador. *Rep. Isotope Geol. Unit, Inst. Geol. Sci.*, No. 76/11. [Unpublished]. [See remarks for 837].
 105. BEEBE W. (1924) *Galápagos, World's end*. (New York and London: Putnam).
 106. BEEBE W. (1926) *The 'Arcturus' Adventure*. (New York: Putnam). [An eruption on Albemarle observed in 1925].
 107. BELL R. E. (1977) Obsidian hydration studies in highland Ecuador. *Amer. Antiquity*, Vol. 42, No. 1 pp. 68-78. [Useful account of hydration measurements on Holocene artefacts correlated with C^{14} dates – see also 132].
 108. BELOWSKY M. (1892) Die Gesteine der ecuatorianischen West Cordillere von Tulcán bis zu den Escaleras-Bergen. [Rock types in the Western Cordillera of Ecuador]. Inaugural dissertation, University of Berlin. [Included in Reiss and Stübel, 1892-1898].

109. BENAVIDES V. (1968) Saline deposits of South America. Pp. 250-290 in *Saline deposits – a symposium based on papers from the International Conference on saline deposits, Houston, Texas 1962*. MATTOX R.B. (Editor) *Spec. Pap. Geol. Soc. Am.*, No. 88. [Pp. 260, 266 reference to saline deposits in the Chapiza Formation of Ecuador]
110. BENNET T. E. (1952) Proyecto de exploración del lignito de Biblián, Ecuador. [Project on the mining of lignite from Biblián, Ecuador]. Report of the U.N. Technical Assistance Programme. [See also 49, 590, 591, 648, 681, 722, 804, 904, 982].
111. BERGT W. (1914) Der Vulkan Quilotoa in Ecuador und seine schiefri gen Laven. [The volcano Quilotoa in Ecuador and its schistose lavas]. *Veröff. Städt. Mus. Länderkunde Leipzig*, No. 13, pp. 22-53.
112. BERGT W. (1921) Natur und Entstehung der Gneise der ekuatorianischen Ostkordillere. [Nature and origin of gneisses in the Eastern Cordillera of Ecuador]. *Zentralbl. Mineral. Geol. Paleontol.*, Jahrg. 1921, pp. 161-168.
113. BERRY E. W. (1918) Age of certain plant-bearing beds and associated marine formations in South America. *Bull. Geol. Soc. Am.*, Vol. 29, pp. 637-648. [Ecuador pp. 640-641. A very general account of Ecuador, but plants at Tablayacu in the Río Jubones basin are recorded].
114. BERRY E. W. (1922) Outlines of S. American geology. *Panam. Geol.*, Vol. 38, pp. 187-216. [A very general work with little of relevance to Ecuador].
115. BERRY E. W. (1923) Extension of Miocene Zorritos Formation in Perú and Ecuador. *Panam. Geol.*, Vol. 40, pp. 15-18. [Despite the title there is only a brief reference (p.17) to the coastal Miocene deposits of Ecuador].
116. BERRY E. W. (1927) Cretacic rocks of Ecuador. *Panam. Geol.*, Vol. 48, pp. 37-38. [A very brief description of thin sections from limestone (?Guayaquil Member) near Guayaquil].
117. BERRY E. W. (1929a) Fossil fruits in the Ancon Sandstone of Ecuador. *J. Paleontol.*, Vol. 3, pp. 298-301.
118. BERRY E. W. (1929b) The fossil flora of the Loja basin in southern Ecuador. *Stud. Geol., Johns Hopkins Univ.*, No. 10, pp. 79-136. [See also 122 and 281].
119. BERRY E. W. (1932) A new palm from the Upper Eocene of Ecuador. *J. Washington Acad. Sci.*, Vol. 22, pp. 327-329.
120. BERRY E. W. (1934) Pliocene in the Cuenca basin of Ecuador. *J. Washington Acad. Sci.*, Vol. 24, pp. 184-186. [Not very relevant to the Cuenca basin]
121. BERRY E. W. (1942) Mesozoic and Cenozoic plants of South America, Central America and the Antilles. *8th Int. Am. Sci. Congr.* Vol. 4, pp. 365-373.
122. BERRY E. W. (1945) Fossil floras from southern Ecuador. *Stud. Geol., John Hopkins Univ.*, No. 14, pp. 93-150.
123. BERRY L. W. (1916) General and geological report on the petroliferous area of Santa Elena Peninsula, Ecuador. *Geol. Rep. Anglo Ecuadorian Oilfields Ltd.*, No. 1. [Unpublished]. [Of historical, rather than stratigraphical interest].
124. BILLINGSLEY P. (1926) Geology of the Zaruma Gold District of Ecuador. *Trans. Am. Inst. Min. Metall. Eng.* No. 74, pp. 255-275. [The first detailed account of the stratigraphy of this area – see also 905].
125. BISHOP A. C., JONES V., MOORE D. T. and WOOLLEY A. R. (1971) *Catalogue of the rock collections in the British Museum (Natural History)*. (London: British Museum, Natural History). [Ecuador, p. 39].
126. BLACK C. D. G. (1957) Studies in the revision of the geology of the Ancon area – III. Quebrada Seca – Punta Membra. *Geol. Rep. Anglo Ecuadorian Oilfields Ltd.*, No. 80. [Unpublished]. [Needs to be read in the light of 209].
127. BLACK C. D. G. (1958) The geology of the Colonche-Aguadita area. *Geol. Rep. Anglo Ecuadorian Oilfields Ltd.*, No. 110. [Unpublished]. [Needs to be read in the light of 209].
128. BLACK C. D. G. (1960) The geology of the San Miguel-Valdivia area. *Geol. Rep. Anglo Ecuadorian Oilfields Ltd.*, No. 117. [Unpublished]. [Needs to be read in the light of 209].
129. BLANCHARD E. (1893; 1894) Explorations des Îles Galapagos, par Alexander Agassiz. [Explorations of the Galapagos Islands, by Alexander Agassiz]. *J. Savants.*, pp. 754-758; 112-116.
130. BOLD W. A. VAN DEN (1976) Distribution of species of the tribe Cyprideidini (Ostracoda, Cytherideidae) in the Neogene of the Caribbean. *Micropaleontol.*, Vol. 22, pp. 1-43. [Ecuador pp. 10, 14, 26. Vetustocytheridea bristowi described from the Cuenca basin].
131. BOLVIKEN G. (1967) Survey of metallic and non-metallic minerals. Termination report, part I, geochemical prospecting, part II, planning and organization of chemical laboratory. *Rep. U.N. Dev. Programme*, No. BB1 [Unpublished].
132. BONIFAZ E. (1972) *Microfilitas arqueológicas*. (Quito: Impresor Cotopaxi). [Interesting dates obtained by measuring the hydration rim of obsidian flakes – see also 107].
133. BONNEY T.G. (1884) Notes on the microscopic structure of some rocks from the Andes of Ecuador, collected by E. Whymper. *Proc. R. Soc., London*, Vol. 36, No. 1. (Pichincha), pp. 241-248; No. 2 (Antisana), pp. 426-434; Vol. 37, No. 3 (Cotopaxi and Chimborazo) pp. 114-131; No.4 (Carihuairazo, Cayambe and Corazón) pp. 131-137; No. 5 (Conclusion: Altar, Illiniza, Sincholagua, Cotacachi, Saraurcu, etc.) pp. 394-410.
134. BONNEY T.G. (1891) Note on the rocks from the Andes. Pp. 140-143 in *Supplementary appendix to travels amongst the Great Andes of the Equator*. WHYMPER E. (Author). [London: Murray]
135. BOSWORTH T. O. (1922) *Geology of the Tertiary and Quaternary periods in the north-west part of Perú (with an account of the palaeontology by H. Woods, T. W. Vaughan, J. A. Cushman etc.)*. [London: Macmillan]. [The first reference (pp. 158, 196, 207) by name, to the Tablazo Formation of Ecuador].
136. BOUSSINGAULT J. B. (1835a) Sur les tremblements de terre des Andes. [On the earthquakes of the Andes]. *Ann. Chim. Phys.*, Vol. 58, pp. 81-88.
137. BOUSSINGAULT J. B. (1835b) Ascension au Chimborazo exécutée le 16 Decembre, 1831. [Ascent of Chimborazo undertaken on 16 December 1831]. *Ann. Chim. Phys.*, Vol. 58, pp. 150-180.
138. BOWMAN R. I. (Editor) (1966) *The Galápagos. Proceedings of the Symposium of the Galápagos International Scientific Project*. (Berkeley and Los Angeles: University of California Press.)
139. BOZANIC D. (1957) Chronologic stratigraphic chart southwest Ecuador. Unpublished report of the California Ecuadorian Petroleum Co.
140. BRANCO W. (1883) Über eine fossile Säugethier-Fauna von Punín bei Riobamba in Ecuador. 11. Beschreibung der Fauna. [Concerning a fossil mammalian fauna at Punín near Riobamba in Ecuador. 11. Description of the fauna]. *Palaeontol. Abh.* Vol. 1, No. 2, pp. 57-204. Spanish translation by GOLDBAUM W. *An. Univ. Cent. Ecuador*, 1938. Vol. 61, No. 305, pp. 395-556. [See 427 for a synthesis of all the known Ecuadorian Pleistocene mammals].

141. BRAUN A. F. (1978) Der Vulkan Cotopaxi, seine Phänomene und forschungsgeschichtliche Bedeutung. [Cotopaxi volcano, its phenomena and importance in the history of research]. *Zentralbl. Geol. Paläontol.* Teil 1, Heft 5/6, pp. 476-488.
142. BREISTROFFER M. (1952) Sur la découverte de Knemiceratinae (Ammonites albiennes) en Equateur, en Colombie et au Vénézuëla. [On the discovery of Knemiceratinae (Albian ammonites) in Ecuador, Colombia and Venezuela]. *C.R. Hebd. Séances Acad. Sci., Paris*, Vol. 234, pp. 2633-2635.
143. BRISTOW C. R. (1973) *Guide to the geology of the Cuenca Basin, southern Ecuador*. (Quito: Ecuadorian Geological and Geophysical Society). [At the time of publication, the most up-to-date account of the geology and palaeontology of the Cuenca Basin – see 510, 543, 648, 801, 904].
144. BRISTOW C. R. (1975) On the age of the Zapotal Sands of southwest Ecuador. *Newsl. Stratigr.*, Vol. 4, No. 2, pp. 119-134. [Resolves the question of the Hannatoma fauna in Ecuador – see 539, 633, 810 and 811].
145. BRISTOW C. R. (1976a) The age of the Cayo Formation, Ecuador. *Newsl. Stratigr.*, Vol. 4, No. 3, pp. 169-173. [Revises the age of the base of the Cayo Formation from Cenomanian to Senonian – see also 811].
146. BRISTOW C. R. (1976b) The Charapotó Formation, Ecuador. *Newsl. Stratigr.*, Vol. 5, No. 2/3, pp. 99-103. [Demonstrates that the Charapotó 'Formation' is hybrid, being composed of parts of two formations].
147. BRISTOW C. R. (1976c) On the age of the Nabón Formation, Ecuador. *Newsl. Stratigr.*, Vol. 5, No. 2/3, pp. 104-107. [Places the Nabón Formation in the Miocene, not the Pleistocene].
148. BRISTOW C. R. (1976d) The Daule Group, Ecuador. *Newsl. Stratigr.*, Vol. 5, No. 2/3, pp. 190-200. [Demonstrates that the Daule 'Formation' (see 541) is really a group composed of three formations].
149. BRISTOW C. R. and HOFFSTETTER R. (1977) *Lexique Stratigraphique International*. (2nd Ed.). [Paris: Centre National de la Recherche Scientifique]. [The most up-to-date account of the geology of Ecuador].
150. BRODIE W. M. (1919) Petroleum in Ecuador. *Eng. Min. J.*, Vol. 107, No. 22, pp. 941-944. [Interesting details of the early exploration for oil on the Santa Elena Peninsula of Ecuador].
151. BROGGI J. A. (1937) Sobre la geología del Bajo Zarumilla. [On the geology of Bajo (Lower) Zarumilla]. Unpublished report to the government as geologist of the Mixed Commission of Boundaries between Perú and Ecuador. Lima. [Nothing directly relevant to Ecuador, but the geology is a continuation of that seen in southern Ecuador].
152. BROGGI J. A. (1939-1940) Fisiografía y estratigrafía de Zarumilla. [Physiography and stratigraphy of Zarumilla]. *Actas Acad. Nac. Cienc. Lima*, Vol. 2, Pt. 1.
153. BROWN C. B. (1922) Report on the geology of the Ancon Field, Part II. Geology of the Ancon Field. *Geol. Rep. Anglo Ecuadorian Oilfields Ltd.*, No. 6. [Unpublished]. [An important historical paper in which some of the present-day stratigraphic terminology was introduced. Needs to be read in the light of 209].
154. BROWN C. B. (1938) On a theory of gravitational sliding applied to the Tertiary of Ancon, Ecuador. *Q. J. Geol. Soc., London*, Vol. 94, pp. 359-370. [Needs to be read in the light of 209 – see also 90, 178, 536, 774, 778, 800, 806].
155. BROWN C. B. and BALDRY R. A. (1925) On the Clay Pebble-Bed of Ancon (Ecuador). *Q. J. Geol. Soc., London*, Vol. 81, pp. 454-460. [Needs to be read in the light of 209 – see also 90, 154, 178, 536, 774, 778, 780, 800, 806].
156. BROWN C. B. and BUSHNELL G. H. S. (1935) A review of the progress of the Ancon field in recent years and of the probable lines of development from the geological standpoint. *Geol. Rep. Anglo Ecuadorian Oilfields Ltd.*, No. 35 [Unpublished]. [Some of the present-day stratigraphic terminology was introduced here].
157. BROWN R. S. (1959) Reconnaissance geologic map of the western part of the Daule concession, Guayas and Manabí Provinces, Ecuador. Unpublished map of Tennessee del Ecuador, S. A.
158. BROWN R. W. (1946) Walnuts from the late Tertiary of Ecuador. *Am. J. Sci.*, Vol. 244, No. 8, pp. 554-556.
159. BROWN R. W. (1956) Ivory-nut palm from late Tertiary of Ecuador. *Sci., New York*, Vol. 123, No. 3208, pp. 1131-1132.
160. BRUET E. (1947a) L'état actuel de nos connaissances géologique sur le Haut-Amazone de l'Equateur. [The actual state of geological knowledge of the Upper Amazon of Ecuador]. *C. R. Séances Soc. Géol. Fr.*, No. 4, pp. 61-64.
161. BRUET E. (1947b) Glaciations pléistocènes sous l'Equateur. [Pleistocene glaciations in Ecuador]. *C. R. Séances Soc. Géol. Fr.*, No. 7, pp. 131-133.
162. BRUET E. (1947c) La géologie de l'Altiplano, sur le territoire de l'Equateur [The geology of the Altiplano, in the territory of Ecuador]. *C. R. Séances Soc. Géol. Fr.*, No. 11, pp. 226-228.
163. BRUET E. (1947d) Sur le soulèvement principal de la Cordillère Orientale des Andes de l'Equateur et la création du réseau de Haut-Amazone. [On the principal uplifting of the Cordillera Oriental of the Ecuadorian Andes and the creation of the river system of the Upper Amazon]. *C. R. Hebd. Séances Acad. Sci., Paris*, Vol. 225, No. 17, pp. 794-751.
164. BRUET E. (1947e) Glaciations pléistocènes et terrasses climatiques en Equateur. [Pleistocene glaciations and climatic terranes in Ecuador]. *Bull. Assoc. Geogr. Fr.*, No. 188-189, pp. 90-99.
165. BRUET E. (1947f) Formation fossile de Ctypéite dans la Cordillère Orientale des Andes de l'Equateur. [The formation of fossil aragonite in the Cordillera Oriental of the Andes of Ecuador]. *C. R. Séances Soc. Geol. Fr.*, No. 15, pp. 307-309.
166. BRUET E. (1948) Nouvelles données sur la structure des Andes de l'Equateur. [New data on the structure of the Andes of Ecuador]. *C. R. Hebd. Séances Acad. Sci., Paris*, Vol. 226, No. 17, pp. 1383-1384.
167. BRUET E. (1949) Les enclaves des laves des volcans de Quito, République de l'Equateur. [The inclusions of lavas of the volcanoes of Quito]. *Bull. Soc. Géol. Fr.*, Vol. 19, Nos. 4-6, pp. 477-491.
168. BRUET E. (1950) Le loess de la République de l'Equateur et ses nids fossiles d'Insectes. [The loess of the Republic of Ecuador and the nests of fossil insects]. *Rev. Fr. Entomol.*, Vol. 17, No. 4, pp. 280-283.
169. BRUET E. (1951-1952) Mouvements épeirogéniques récentes sur la côte pacifique de l'Equateur et de la Colombie. [Recent epeirogenic movements on the Pacific coast of Ecuador and Colombia]. *Cah. Geol. Thoiry*, Nos. 9, 10, pp. 79-83.

170. BRUET E. (1952) Le substratum éruptif des volcans Tungurahua et Cotopaxi de la cordillère centrale des Andes de l'Équateur. [The eruptive substratum of the Tungurahua and Cotopaxi volcanoes of the central cordillera of the Andes of Ecuador]. *C. R. Séances, Soc. Géol. Fr.*, No. 5-6, pp. 92-93.
171. BUCH L. VON (1816) Von den geognostischen Verhältnissen des Trapp-Porphyr. [The geology of porphyry traps]. *Abh. K. Akad. Wiss. Berlin*, Ser. 5, Vol. 4, for 1812-1813, pp. 129-154.
172. BUCH L. VON (1839) *Pétrifications recueillies en Amérique, par Mr. Alexandre de Humboldt et par Mr. Charles Degenhardt*. [Fossils collected in America by Mr. Alexandre de Humboldt and by Mr. Charles Degenhardt]. (Berlin: Imp. Acad. R. Soc.) [A poor (Miocene) fauna from the Cuenca Basin erroneously attributed to the Cretaceous – see 143, 510, 543].
173. BUIS O. J. (1972) El Cretáceo: principal productor. *Pet. Petroquim. Int.*, Vol. 30, No. 1, pp. 47-50.
174. BUNSEN R. (1861) Über die Prozesse der vulkanischen Gesteinbildungen Islands. [Concerning the processes of volcanic rock formation in Iceland]. *Am. Phys.* Vol. 83, pp. 197-272.
175. BURLEIGH R. and BROTHWELL D. (1978) Studies on Amerindian dogs; 1, Carbon isotopes in relation to maize in the diet of domestic dogs from early Perú and Ecuador. *J. Archaeol. Sci.*, Vol. 5, No. 4, pp. 355-362.
176. BURROUGHS W. G. (1915) Coal fields of South America. *Colliery Eng.*, Scranton, Vol. 35. [Ecuador p. 644].
177. BUSHNELL G. H. S. (1938) A geological reconnaissance of the Island of Puna. Geological Report Anglo Ecuadorian Oilfields Ltd. [Unpublished]. [One of the earliest reports about this poorly known island – see also 675].
178. BUSK H. G. (1931) The Clay Pebble Bed of Ancon, Ecuador, *Geol. Mag.*, Vol. 68, p. 240. [Needs to be read in the light of 209 – see also 90, 154, 536, 774, 800, 806].
179. BUSK H. G. (1938) Ecuador. *Sci. Pet.*, Vol. 1, pp. 118-119.
180. BUSK H. G. (1941) The geology of the Ancón Oilfield and its perimeter, with notes on water supply. *Geol. Rep. Ecuador Oilfields Ltd.*, No. 16 [Unpublished].
- C**
181. CAMERON A. R. (1947) Informes geológicos y geofísicos de la International Ecuadorian Petroleum Co.: 1) Concesión E. Gonzáles G.; 2) Concesión A. Gonzáles G.; 3) Concesión Ayora. [Geological and geophysical report of the International Ecuadorian Petroleum Company: 1) Concession E. Gonzales G.; 2) Concession A. Gonzales G.; 3) Concession Ayora.] Unpublished report of the Dirección de Minería y Petróleo; Ministerio Económico, Quito. [Important unpublished report of the results of the IEPG; abstracted material published in 188 and 431. Maps incorporated in 1:1000000 geological map of Ecuador (1969). Many of the Stratal terms currently in use stem from this and associated reports – see 756, 870].
182. CAMPBELL C. J. (1970) *Guidebook to the Puerto Napo area, eastern Ecuador, with notes on the regional geology of the Oriente Basin*. (Quito: Ecuadorian Geological and Geophysical Society). [This, the second guidebook of the Society, is the first detailed published account of Oriente geology since 1953 – see 897, 898].
183. CAMPBELL C. J. (1974) Ecuadorian Andes. Pp. 725-732 in Mesozoic-Cenozoic orogenic belts, data for orogenic studies; Circum-Pacific and Caribbean orogens. *Spec. Publ. Geol. Soc. London*, No. 4. [A wider treatment of Oriente and Andean geology than 182]
184. CAMPBELL C. J. (1975) Ecuador. Pp. 261-270 in *Encyclopedia of Earth science series*. Vol. 8. (Stroudsburg, Pennsylvania: Fairbridge).
185. CAMPBELL K. E. Jr. (1976) The late Pleistocene avifauna of La Carolina, southwestern Ecuador. *Smithson. Contrib. Paleobiol.*, No. 27, pp. 155-168.
186. CAMPBELL SMITH W. (1932) *Catalogue of the rock collections in the Mineral Department of the British Museum (Natural History) arranged geographically. Part II America*. (London: British Museum, Natural History). [Ecuador, pp. 125-126].
187. CAMPSIE J., BAILEY J. C. and RAMUSSEN M. (1973) Chemistry of tholeiites from the Galápagos Islands and adjacent ridges. *Nature, London*, Vol. 245, pp. 122-124.
188. CANFIELD R. W. (1966) *Geological report of the coast of Ecuador*. (Quito: Ministerio de Industrias y Comercio) [The same report was also published in Spanish (Reporte Geológico de la Costa ecuatoriana), but with differing pagination. An excellent synthesis of all the published and unpublished material then available. Included is the first detailed, colour-printed map (1:500000) of coastal Ecuador, and an extensive bibliography].
189. CARMICHAEL J. S. E., TURNER F. J. and VERHOOGEN J. (1974) *Igneous petrology*. (New York: McGraw-Hill). [Galápagos Islands pp. 395-402].
190. CASE J. E., DURÁN L. G., LÓPEZ A. and MOORE W. R. (1971) Tectonic investigations in western Colombia and eastern Panamá. *Bull. Geol. Soc. Am.*, Vol. 82, pp. 2685-2711.
191. CASE J. E., RYLAND S. L., SIMKIN T. and HOWARD K. A. (1973) Gravitational evidence for a low-density mass beneath the Galápagos Islands. *Science, New York*, No. 181, pp. 1040-1042.
192. CASTAÑO L. (1972) La región Este del Ecuador tiene todavía prometedor potencial. [The Eastern region of Ecuador still has promising potential]. *Pet. Petroquim. Int.*, Vol. 30, No. 8, pp. 64-70.
193. CASTELLANOS A. (1957) *Hoffstetteria* nuevo género de clamiterio. [Hoffstetteria, new genus of clamiterio]. *Ameghiniana*, Vol. 1, No. 3, p. 5-8. [This proposed new genus is a synonym of Holmesina – see 434]
194. CAUQUOIN M. (1969) Mollusques récoltés par M. Hoffstetter sur les côtes de l'Équateur et aux Îles Galapagos. Mactridae. [Molluscs collected by M. Hoffstetter on the coasts of Ecuador and on the Galapagos Islands. Mactridae]. *Bull. Mus. Natl. Hist. Nat., Paris*, 2nd Ser., Vol. 40, No. 5, pp. 1019-1030. [See also 309].
195. CHAMBERS G. (1893) Ecuador – report (with translation) on the new mining law of Ecuador. *Misc. Ser. Foreign. Off., London*, No. 273, 6 pp.
196. CHESTERMAN C. W. (1963) Contributions to the petrography of the Galápagos, Cocos, Malpelo, Cedros, San Benito, Tres Marias and White Friars Islands. *Proc. California Acad. Sci.*, Ser. 4, Vol. 32, No. 11, pp. 339-362.
197. CHUBB J. (1925) The St. George scientific expedition. *Geol. Mag.*, Vol. 62, pp. 369-373.
198. CHUBB J. (1933) Geology of Galápagos, Cocos and Easter Islands; with petrology of Galápagos Islands by C. Richardson. *Bull. Bernice P. Bishop. Mus.*, No. 110.
199. CLAPP F. G. (1917) Review of present knowledge regarding the petroleum resources of South America. *Bull. Am. Inst. Min. Metall. Eng.* [Ecuador, pp. 1775-1780]

200. CLAVERY E. (1925) A propos de la découverte d'ossements de Mylodon à Cotocollao (Equateur). [Concerning the discovery of bones of Mylodon at Cotocollao (Ecuador)]. *Nature, Paris*, 2689, pp. 244-245. [See 427 for a synthesis of all the known Ecuadorian Pleistocene mammals].
201. COLE W. S. (1953) Eocene and Oligocene larger foraminifera from the Panamá Canal Zone and vicinity. *Prof. Pap. US Geol. Surv.*, No. 244, pp. 1-41.
202. COLE W. S. (1964) American mid-Tertiary Miogypsinid-Foraminifera: classification and zonation. *Contrib. Cushman Found. Foraminiferal Res.*, Vol. 15, pt 4, pp. 138-150
203. COLINVAUX P. A. (1968a) Paleolimnological investigations in the Galápagos Archipelago. *Not. Galápagos*, Vol. 11, pp. 13-18.
204. COLINVAUX P. A. (1968b) Reconnaissance and chemistry of the lakes and bogs of the Galápagos Islands. *Nature, London*, Vol. 219, p. 590.
205. COLINVAUX P. A. (1968c) Eruption on Narborough. *Animals*, Vol. 11, No. 7, pp. 296-301.
206. COLLIN DELAUAUD A. (1976) La morphogenèse des plaines et des collines du secteur occidental de l'Equateur. *Bull. Inst. Fr. Etud. Andines*, Vol. 5, Nos. 3-4, pp. 1-11.
207. COLLINS J. S. H. and MORRIS S. F. (1976) Tertiary and Pleistocene crabs from Barbados and Trinidad. *Paleontol.*, Vol. 19, pp. 107-131.
208. COLMAN J. A. R. (1966) Summary of information relating to test wells and coreholes of the Progreso Basin, with notes on the stratigraphic units of the Guayas region. *Rep. Anglo Ecuadorian Oilfields Ltd.*, No. J. A.C. 12, [Unpublished.] [Very useful notes on the stratigraphic terminology of the Guayas Province, together with summary logs of many of the deep wells of this region].
209. COLMAN J. A. R. (1970) *Guidebook to the geology of the Santa Elena Peninsula*. (Quito: Ecuadorian Geological and Geophysical Society). [This, the first guidebook of the Society, unfortunately had a rather limited circulation. In it the olistostromic theory, as put forward in unpublished reports 81, 82 and 83, to explain the complex geology of the Santa Elena Peninsula was published. A very important paper].
210. COLMET-DAAGE F., CUCALON F., DELAUNE M., GAUTHEYROU J. & M. and MOREAU B. (1967a) Caractéristiques de quelques sols d'Équateur dérivés de cendres volcaniques; 1ère partie, essai de caractérisation de sols des régions tropicales humides. [Characteristics of some soils of Ecuador derived from volcanic ash, Part 1, test of characteristics of soils from tropical humid regions]. *Cah. Off. Rech. Sci. Tech. Outre-Mer, Sér. Pédol.*, Vol. 5, No. 1, pp. 3-38.
211. COLMET-DAAGE F., CUCALON F., DELAUNE M., GAUTHEYROU J. & M. and MOREAU B. (1967b) Caractéristiques de quelques sols d'Équateur dérivés de cendres volcaniques; deuxième partie, conditions de formation et d'évolution. [Characteristics of some soils of Ecuador derived from volcanic ash, Part 2, conditions of formation and evolution]. *Cah. Off. Rech. Sci. Tech. Outre-Mer, Sér. Pédol.*, Vol. 5, No. 4, pp. 353-392.
212. COLMET-DAAGE F., KIMPE C. DE, DELAUNE M., SIEFFERMAN G., GAUTHEYROU J. & M., FUSIL G., and KOUKOU M. (1970) Caractéristiques de quelques sols d'Équateur dérivés de cendres volcaniques; 3^e partie. Comparaison de l'évolution de quelques sols des régions tropicales chaudes et tempérées froides d'altitude. [Characteristics of some soils of Ecuador derived from volcanic ash, Part 3. Comparison of the evolution of some soils of warm regions of the tropics and cold-temperate regions at altitude]. *Cah. Off. Rech. Sci. Tech. Outre-Mer, Sér. Pédol.*, Vol. 7 [for 1969], No. 4, pp. 495-560.
213. COLOMA SILVA E. (1939) *La minería y el petróleo en el Ecuador. (Informe anual 1938-1939)*. [Mining and petroleum in Ecuador (Annual report 1938-1939)] (Quito). [Some stratal units named by the oil companies first published here].
214. COLOMA SILVA E. (1940a) *La minería y el petróleo en el Ecuador (Informe anual 1939-1940)*. [Mining and petroleum in Ecuador (Annual report 1939-1940)] (Quito).
215. COLOMA SILVA E. (1940b) *15 años de producción petrolera en el Ecuador 1925-1939*. [15 years of petroleum production in Ecuador 1925-1939]. (Quito: Ministerio de Minas).
216. COLOMA SILVA E. (1941) *La minería y el petróleo en el Ecuador (Informe anual 1941)*. [Mining and petroleum in Ecuador (Annual report 1941)] (Quito). [Several unpublished names used by various oil companies were first published here].
217. COLOMA SILVA E. (1954) *Ecuador's oil production still confined to Santa Elena Península*. *Pet. Interam.*, Vol. 12, pp. 91-98.
218. COLONY R.J. and SINCLAIR J.H. (1928) The lavas of the volcano Sumaco, eastern Ecuador, South America. *Am. J. Sci.*, Series 5, Vol. 16, pp. 299-312. Spanish translation by GUERREJO J. *Bol. Mens. Minist. Obras Públ.*, Quito, 1937, Vol. 2, Nos. 18-20, pp. 89-97. [One of the earliest accounts of the geology of the Oriente (see also 938), and still the only published account of Sumaco]
219. COLONY R.J. and SINCLAIR J.H. (1932) Metamorphic and igneous rocks of eastern Ecuador. *Ann. New York Acad. Sci.*, Vol. 34, pp. 1-53. Spanish translation by GUERREJO J. *Bol. Mens. Minist. Obras Públ.*, Quito, 1937, Vol. 2, Nos. 18-20, pp. 3-31.
220. COLONY W. E. and NORDLIE B. E. (1973) Liquid sulfur at Volcan Azufre, Galápagos Islands. *Econ. Geol.*, Vol. 68, pp. 371-380.
221. COLTON R. B. (1968) Bibliography of geology and geography of Ecuador. Open file report, US Geological Survey, Washington. 65pp.
222. COOKE C. W. (1955) Some Cretaceous echinoids from the Americas. *Prof. Pap. US Geol. Surv.*, No. 264-E, pp. 87-112. [Hemiastr texanus is recorded from the Napo Formation (p. 109)].
223. COSTALES SAMANIEGO A. (1950) *Mastodon Chimborazi*. Proaño. *Bol. Inf. Cient. Nac. Quito*, Vol. 3, No. 35, pp. 372-375. [See 427 for a synthesis of all the known Ecuadorian Pleistocene mammals].
224. COTECCHIA V. and ZEZZA F. (1969) The Eocene basement of the International corridor in the Latacunga-Ambato trough (Ecuador). *Geol. Appl. Idrogeol.*, Vol. 4, pp. 43-56. [Contains the first published radiometric (K:Ar) date from Ecuador, and the first evidence of Eocene rocks in the Ecuadorian Andes.]
225. COTECCHIA V. and ZEZZA F. (1974) Geology and geotechnical properties of the sedimentary and volcanic formations of the Tungurahua and Cotopaxi provinces (Ecuadorian Andes), referring to engineering works for water and power supply of the region. *Semin. Inter. Valut. Terre Aride Semiaride dell' America Latina, Roma*.
226. COX A. (1966) Continental drift in the southern hemisphere. Pp. 78-86 in BOWMAN R. I. 1966
227. COX A. (1969) Geomagnetic reversals. *Science, New York*, No. 163, pp. 237-245
228. COX A. (1971) Paleomagnetism of San Cristobal Island, Galápagos. *Earth & Planetary Sci. Lett.*, No. 11, pp. 152-160.

229. COX A. (1975) The Galápagos Islands: A migrating volcanic chain near a triple junction. *Newsl. Geol. Soc., London*, Vol. 4, No. 1, p. 11.
230. COX A. and DALRYMPLE G. B. (1966) Paleomagnetism and potassium-argon ages of some volcanic rocks from the Galápagos. *Nature, London*, No. 209, pp. 776-777. [The K:Ar dates are at variance with the paleontological dating – see 240, 241; also 242].
231. CRAIG H. C. (1920) Oilfinding (2nd. Ed.). (London).
232. CUSHMAN J. A. (1929) A late Tertiary fauna of Venezuela and other related regions. *Contrib. Cushman Lab. Foraminiferal Res.*, Vol. 5, pt. 4, pp. 77-105.
233. CUSHMAN J. A. and EDWARDS P. (1938) Notes on the Oligocene species of *Uvigerina* and *Angulogerina*. *Contrib. Cushman Lab. Foraminiferal Res.*, Vol. 14, pt. 4, pp. 74-89.
234. CUSHMAN J. A. and STAINFORTH R. M. (1946) A new species of *Amphistegina* from the Eocene of Ecuador. *Contrib. Cushman Lab. Foraminiferal Res.*, Vol. 22, pt. 4, pp. 117-119.
235. CUSHMAN J. A. and STAINFORTH R. M. (1947) A new genus and some new species from the Upper Eocene of Ecuador. *Contrib. Cushman Lab. Foraminiferal Res.*, Vol. 23, p. 77.
236. CUSHMAN J. A. and STAINFORTH R. M. (1951) Tertiary foraminifera of coastal Ecuador. Part I, Eocene. *J. Paleontol.*, Vol. 25, No. 2, pp. 129-164. [Discusses not just the Eocene faunas, but also the faunas and stratigraphy of deposits which at that time were regarded as Oligocene (now = Lower Miocene). This work was amended in 435 and revised in 436].
237. CUSHMAN J.A. and STEVENSON F. V. (1948) A Miocene foraminiferal fauna from Ecuador. *Contrib. Cushman Lab. Foraminiferal Res.*, Vol. 24, pt. 3, pp. 50-68.
238. CUSHMAN J.A. and TODD R. (1941) Species of *Uvigerina* occurring in the American Miocene. *Paleontol.*, Vol. 17, pt. 2, pp. 43-52. [Three species from the Lower Miocene of Manta area reviewed].
239. CUVIER G. (1806) Sur différentes dents du genre des Mastodontes. [On the different teeth of the genera of Mastodons]. *Ann. Mus. Hist. Nat., Paris*, Vol. 8, pp. 401-424.
- D**
240. DALL W. H. (1924) Note on fossiliferous strata on the Galápagos Islands explored by W.H. Ochsner of the expedition of the California Academy of Sciences, in 1905-1906. *Geol. Mag.*, Vol. 61, pp. 428-429. [Palaeontology at variance with 230 and 242].
241. DALL W. H. and OCHSNER W. H. (1928) Tertiary and Pleistocene Mollusca from the Galápagos Islands. *Proc. California Acad. Sci.*, Serv. 4 Vol. 17, No. 4, pp. 89-136. [Palaeontology at variance with 230 and 242].
242. DALRYMPLE G. B. and COX A. (1968) Palaeomagnetism, potassium-argon ages and petrology of some volcanic rocks from the Galápagos Islands. *Nature, London*, Vol. 217, pp. 1-8. [The K:Ar dates are at variance with palaeontology of 240 and 241 – see also 230].
243. DAMON P. E. (1970) Correlation and chronology of ore deposits and volcanic rocks. *Ann. Prog. Rep. US At. Energy Comm.*, No. CCO – 689 – 130, pp. 46-84.
244. DARWIN C. R. (1839) *Journal of researches into the geology and natural history of the various countries, visited by H.M.S. Beagle under command of Captain Fitzroy, from 1832 to 1836*. (London: Colburn). [The earliest account of the geology of the Galápagos Islands (pp. 453-478)].
245. DARWIN C. R. (1844) *Geological observations on the volcanic islands, visited during the voyage of H.M.S. Beagle*. (London: Smith, Elder). [Galápagos Islands pp. 97-116].
246. DARWIN C. R. (1846) *Geological observations on South America. Being the third part of the geology of the voyage of the Beagle... during 1832 to 1836*. (London).
247. DARWIN C. R. (1876) *Geological observations on South America*. (London).
248. DARWIN C. R. (1891) *Geological observations on volcanic islands*. (London: Smith, Elder).
249. DARWIN C. R. (1896) *Geological observations. On the volcanic islands and parts of South America visited during the voyage of H.M.S. Beagle*. (New York: D. Appleton and Co.) [Galápagos Islands, pp. 110-131].
250. DÁVALOS J. C. (1973) A new economy for Ecuador; Texaco and Gulf strike oil. Pp. 73-79 in International economics of minerals and fuels. *Colorado Sc. Mines, Q.*, Vol. 68, No. 4.
251. DAVIES D. M. (1974) Hombre fósil en Ecuador. [Fossil man in Ecuador]. *Ciencias.*, Vol. 36, No. 6, pp. 463-465.
252. DEFFEYES K. S., HEY R., JOHNSON L. and LOWRIE A. (1971) Plate tectonics near the Galápagos Triple Junction. [Abstract]. *Trans. Am. Geophys. Union*, Vol. 52, No. 4, p. 237.
253. DELANY J. R., COLONY W. E., GERLACH T. M. and NORDLIE B. E. (1973) Geology of the Volcan Chico area on Sierra Negra volcano, Galápagos Islands. *Bull. Geol. Soc. Am.*, Vol. 84, pp. 2455-2470.
254. DENNESS B. (1974) An assessment of the landslip hazard of the town of Guaranda. *Rep. Eng. Geol. Div., Inst. Geol. Sci.* [Unpublished] [Also in Spanish].
255. DE PAEPE P. (1966) Geologie van Isla Daphne Mayor (Islas Galápagos). [Geology of Daphne Major Island (Galápagos Islands)]. *Natuurwet. Tijdschr.*, Vol. 48, pp. 67-80.
256. DETRICK R. S., WILLIAMS D. L., MUDIE J. D. and SCLATER J. G. (1974) The Galápagos spreading centre bottom water temperatures and the significance of geothermal heating. *Geophys. J. R. Astron. Soc.*, Vol. 38, pp. 627-637.
257. DOEBI F. and KEHRER W. (1971) Die Cayo-Schichten vom locus typicus bei Puerto Cayo (West Ecuador). [The Cayo Beds of the type locality of Puerto Cayo (West Ecuador)]. Pp. 21-31 in *Neue Ergebnisse Geol. Erforsch. Ibero-Amerikas, Münster, Forsch. Geol. Palaeontol.*, Nos. 20-21.
258. DORFMAN M. H. (1975) A plate tectonic [model] for development of the geology and estimation of potential petroleum reserves in Ecuador. *Nafta, Zagreb*, Vol. 26, Nos. 7-8, pp. 341-358; Vol. 26, No. 12, pp. 614-628. [A speculative, generalised, commonly inaccurate publication, which was out of date at the time it was written. No reference is made to 209].
259. DORR J. B. (1933) New data on the correlation of the Lower Oligocene of South and Central America with that of southern Mexico. *J. Paleontol.*, Vol. 7, pp. 432-438. [The Manta fauna of 326 is assigned to the Lower Oligocene].
260. DRAPER T. W-M. (1894) Gold deposits of Colombia and Ecuador. *Eng. Min. J.*, Vol. 58, p. 532
261. DRESSSEL L. S. J. (1877) Die Vulkane Ecuadors und der jungste Ausbruch des Cotopaxi. [The volcanoes of Ecuador and the most recent eruption of Cotopaxi]. *Stimmen Maria Laach, Freiburg*, Vol. 13, p. 445.
262. DRESSSEL L. S. J. (1879) Erinnerungen an Ecuador. [Recollections of Ecuador]. *Stimmen Maria Laach, Freiburg*, Vol. 17, pp. 190-205.

263. DRESSEL L. S. J. (1903) Los volcanes Sudamericanos en especial los del Ecuador. Una ojeada a la teoría de los volcanes. [The South American Volcanoes, especially of Ecuador. A glance at the theory of the volcanoes]. *An. Univ. Cent. Ecuador*, Vol. 18, pp. 419-435.
264. DRESSEL P. L. (1876) *Estudio sobre algunas aguas minerales del Ecuador*. [A study of some mineral waters of Ecuador]. (Quito).
265. DUNKLE D. H. (1951) New western hemisphere occurrences of fossil Selachians. *J. Washington Acad. Sci.*, Vol. 41, No. 11, pp. 344-347.
266. DUNN P. G. (1975) The porphyry copper of Juanes. *Econ. Geol.*, Vol. 70, p. 1293. [This is a translation of Wolf's (1892) description of the copper deposits at Juanes, which is thought to be the earliest recognition of porphyry copper]
267. DUQUE P. (1975) Petrogénesis de unas rocas metamórficas de alta presión en la Provincia de El Oro. [Petrogenesis of some high-pressure metamorphic rocks in El Oro Province]. Thesis of the Escuela Politécnica Nacional, Quito. [The mapping included in this thesis is incorporated in the 1:50000 geological map of the western part of the El Oro Province].
268. DURHAM J. W. (1964) The Galápagos Islands expedition of 1964. *Annu. Rep. Am. Malacol. Union*, p.53.
269. DURHAM J. W. (1965) Geology of the Galápagos. *Pac. Discovery*, Vol. 18, No.5, pp. 3-6.
270. DWIN A. D. (1964) Ecuador's new mineral development plan. *Eng. Min. J.*, Vol. 165, No. 10, pp. 109-117.
271. DYOTT G. M. (1927) Der vulkan wanderungen in Ecuador. [Wanderings on volcanoes in Ecuador]. *Die Coralle, Berlin*, Vol. 3, pp. 258-261.
272. DYOTT G. M. (1929) The volcanoes of Ecuador. *Natl. Geogr. Mag.*, Vol. 55, No. 1, pp. 49-93.

E

273. EAMES F. E., BANNER F. T., BLOW W. H. and CLARKE W. J. (1962) *Fundamentals of mid-Tertiary stratigraphical correlations*. (Cambridge University Press). [Ref. to Ecuador, p. 38].
274. EAMES F. E., CLARKE W. J., BANNER F. T., SMOUT A. H. and BLOW W. H. (1968) Some larger foraminifera from the Tertiary of Central America. *Palaeontol.*, Vol. 11, pp. 283-305. [Lower Oligocene Playa Rica larger foraminifera of Ecuador, pp. 292-295].
275. EDMUND A. G. (1965) A late Pleistocene fauna from the Santa Elena Península, Ecuador. *Contrib. R. Ontario Mus., Life Sci.*, No. 63, pp. 1-21.
276. EGAS A. (1878) Ausbruch des Cotopaxi im 23 August 1878. [The eruption of Cotopaxi on the 23rd of August 1878]. *Verh. Ges. Erdkd., Berlin*, No. 7-8, pp. 202-203.
277. EIBI EIBESFELD I. (1960) *Galápagos, die Arche Noah im Pacific*. [Galápagos, Noah's Ark in the Pacific]. (München: Verlag, R. Piper and Co.)
278. EICHELBERGER J. C. and GOOLEY R. (1976) Interaction of basalt and rhyolitic magmas. [Abstract]. *Abstr. Programs Geol. Soc. Am.*, Vol. 8., No. 6, pp. 851-852.
279. ELICH E. (1893) *Die Gesteine der ecuatorianischen West-Cordillere vom Atacazo bis zum Iliniza*. [The rocks in the Western Cordillera of Ecuador from Atacazo to Iliniza]. Dissertation, University of Berlin. [Included in Reiss and Stübel, 1892-1898].
280. ELICH E. (1901) *Die vulkanischen Gebirge der Ost-Cordillere vom Pambamarca bis zum Antisana*. *Mineralogisch-petrographische Untersuchung*. [The volcanic mountains of the Eastern Cordillera from Pambamarca to Antisana. Mineralogical-petrographical research]. (Berlin: Asher). [Included in Reiss, 1901-1904].
281. ENGELHARDT H. (1895) Über neue Tertiärpflanzen Südamerikas. [Concerning new Tertiary plants of South America]. *Abh. Senckenb. Naturforsch. Ges.*, Vol. 19, No. 2, pp. 1-47. [First detailed account of the (Miocene) flora from the Loja Basin. Material not stratigraphically located – see also 118, 122].
282. ERAZO M. T. (1951) Excursión geológica a Baños del Tungurahua. [Geological excursión to Baños del Tungurahua]. *An. Univ. Cuenca*, Vol. 7, No. 4, pp. 19-38. [Despite its title, a substantial, important section is devoted to the Cuenca Basin – see also 283].
283. ERAZO M. T. (1957) Apuntes sobre la geología y estructura del Valle de Cuenca. [Notes on the geology and structure of the Cuenca Valley]. *An. Univ. Cuenca*, Vol. 13, No. 1, pp. 157-197. [A very important paper in which, for the first time, a clear concept of the stratigraphy of the Cuenca Basin is published – see also 282].
284. ERAZO M. T. (1961) Estudio petrográfico de objetos arqueológicos de las provincias australes del Ecuador. [Petrographic study of archaeological objects of the southern provinces of Ecuador]. *Cuad. Hist. Arqueol., Guayaquil*, Año 11, Vol. 10, No. 27, pp. 113-126.
285. ERAZO M. T. (1965) *Estudio de los deslizamientos del suelo en el austro*. [Study of landslides in the south]. 26 pp. (Cuenca) [An important contribution to the study of landslips in the Cuenca Basin].
286. ESCH E. (1896) Die Gesteine der ecuatorianischen Ost-Cordillere: Die Berge des Ibarra-Beckens und der Cayambe. [The rocks in the Eastern Cordillera of Ecuador: The mountains of the Ibarra Basin and Cayambe.] Inaugural dissertation, University of Berlin. [Included in Reiss and Stübel, 1896-1902]
287. ESTRADA A. (1941) Contribución geológica para el conocimiento de la Cangagua de la región Interandina y del Cuaternario en general. [Geological contribution to the knowledge of the Cangagua of the Interandean region and of the Quaternary in general]. *An. Univ. Cent., Ecuador*, Vol. 66, No. 312, pp. 405-488.
288. ETZOLD F. (1907) Säugetierreste aus den pleistozänen Tuffen von Punín, Ecuador. [Mammalian remains from the Pleistocene tuff at Punín, Ecuador]. Pp. 528-538 in *In den Hoch Anden von Ecuador, II*. [In the High Andes of Ecuador, II] (Berlin: Reimer). Spanish translation by ESPINOSA R., *An. Univ. Cent., Ecuador*, 1936, Vol. 57, No. 298, pp. 379-391. [See also 427 for a synthesis of all the known Pleistocene mammals of Ecuador].
289. ETZOLD F. (1939) Restos de mamíferos extraídos de las tobas pleistocénicas de Punín, Ecuador. [Remains of mammals from the Pleistocene tuff of Punín, Ecuador]. *An. Univ. Cent., Ecuador*, Vol. 62, No. 307, pp. 59-70. [See remarks as for 288].
290. EVANS C. and MEGGERS B. J. (1961) Cronología relativa y absoluta en la Costa del Ecuador. [Relative and absolute chronology in the Ecuadorian coast]. *Cuad. Hist. Arqueol.*, Año 11, Vol. 10, No. 27, pp. 147-152.

F

291. FAUCHER B., JOYES R., MAGNÉ F., GRANJA V. J., GRANJA B. J. C., CASTRO R. and GUEVARA G. (1968) *Informe geológico sobre las posibilidades petroleras de las provincias costeras de la República del Ecuador*. [Geological report on the petroleum possibilities of the coastal provinces of Ecuador]. Institut Français du Pétrole. (Quito: Servicio Nacional de Geología y Minas).

- 292.FAUCHER B., JOYES R., MAGNÉ F., SIGAL J., VERNET R., GRANJA V. J., GRANJA B. J. C., CASTRO R. and GUEVARA G. (1968a) *Estudio preliminar sobre los principales problemas geológicos concernientes a la exploración petrolera del Oriente ecuatoriano*. [Preliminary study on the main geological problems concerned in the oil exploration of the Ecuadorian Oriente]. Institut Français du Pétrole. (Quito: Servicio Nacional de Geología y Minas).
- 293.FAUCHER B., JOYES R., MAGNÉ F., SIGAL J., VERNET R., GRANJA V. J., GRANJA B. J. C., CASTRO R. and GUEVARA G. (1968b) *Estudios geológicos sobre la cuenca sedimentaria de Manabí, Montañas de Jama Cuaque y región de Quinindé*. [Geological studies of the sedimentary basins of Manabí, Mountains of Jama Cuaque and region of Quinindé]. Institut Français du Pétrole. (Quito: Servicio Nacional de Geología y Minas). [Important publication with a limited distribution. It contains much useful information, particularly of the Tertiary strata. No plates accompany the foraminiferal lists. Material incorporated in 295].
- 294.FAUCHER B. and SAVOYAT E. (1973) Esquisse géologique des Andes de l'Equateur. [Geological sketch of the Andes of Ecuador]. *Rev. Géogr. Phys. Géol. Dyn. Ser. 2*, Vol. 15, Fascicule 1-2, pp. 115-142.
- 295.FAUCHER B., VERNET R., BIZON G., BIZON J. J., GREKOFF N., LYS M. and SIGAL J. (1971) *Sedimentary formations in Ecuador. A stratigraphic and micropaleontological survey*. (Bureau d'études industrielles et de coopération de l'Institut Français du Pétrole (BEICIP)). [A glossy, very expensive, limited publication incorporating 292, 293, 755, 756 and 814. Plates of many of the foraminifera and ostracoda].
- 296.FEININGER T. (1974a) Organization of the mineralogic and petrographic collections at the Escuela Politécnica Nacional, Quito, Ecuador. *J. Geol. Educ.*, Vol. 22, No. 3, pp. 104-107.
- 297.FEININGER T. (1974b) Andean metamorphic rocks of Colombia and Ecuador. *Geol. Soc. Am. Abstr.*, with Programs, Vol. 6, No. 7.
- 298.FEININGER T. (1975) Origin of petroleum in the Oriente of Ecuador. *Bull. Am. Assoc. Pet. Geol.*, Vol. 59, No. 7, pp. 1166-1175. [A controversial, but stimulating, new hypothesis to explain the presence/absence of petroleum in the Oriente].
- 299.FEININGER T. (1976) Mapa gravimétrico Bouguer del Ecuador (1:1000000). Instituto Geográfico Militar, Quito. [A compilation of all the gravity data, particularly from the oil companies, available in Ecuador].
- 300.FEININGER T. (1980) Eclogite and related high-pressure regional metamorphic rocks from the Andes of Ecuador. *J. Petrol.*, Vol. 21, No. 1.
- 301.FEININGER T. (*In press*) Mapa geológico de la parte occidental de la Provincia de El Oro (1:50000). [Geological map of the western part of the El Oro Province (1:50000)] (Quito: Escuela Politécnica Nacional). [The first detailed map of an extremely interesting area of metamorphic rocks].
- 302.FEININGER T. and BRISTOW C. R. (1980) Cretaceous and Paleogene geologic history of coastal Ecuador. *Geol. Rundsch.* Vol. 69, pp. 849-874.
- 303.FERNÁNDEZ DE LARA G. A. (1953) Hydrology und utilization of hydraulic resources in the arid and semi-arid areas of Latin America. Pp. 153-178 in *Reviews of research on arid zone hydrology*. (Paris: Unesco). [Ecuador, pp. 163-176-177].
- 304.FESTER G. A. and CRUELLAS J. (1935) Le Pétrole en Équateur. [Petroleum in Ecuador]. *Rev. Pétrolithère*, No. 647, pp. 1143-1144.
- 305.FETTER T. W. (1927) A salt famine in Ecuador. *Am Econ. Rev.*, Vol. 17, pp. 478-479.
- 306.FIELDS R. W. (1957) Hystricomorph rodents from the late Miocene of Colombia, South America. *Univ. California Publ. Geol. Sci.*, Vol. 32, No. 5, pp. 273-403. [Gives considerable detail (pp. 323-357) of *Olenopsis aequatorialis* (Anthony) first described from Nabón. The 'Late' Miocene (Vindobonian) of Fields is currently regarded as Middle Miocene].
- 307.FILSON J., SIMKIN T. and LEI-KUANG LEU (1973) Seismicity of a caldera collapse: Galápagos Islands 1968. *J. Geophys. Res.*, Vol. 78, pp. 8591-8622.
- 308.FINLAY J. R. (1901) Notes on the gold-mines of Zaruma, Ecuador. *Trans. Am. Inst. Min. Metall. Eng.*, Vol. 30, pp. 248-260.
- 309.FISCHER-PIETTE E. (1969) Mollusques récoltés par M. Hoffstetter sur le côtes de l'Equateur et des Îles Galapagos. Veneridae [Molluscs collected by M. Hoffstetter on the coast of Ecuador and the Galápagos Islands. Veneridae]. *Bull. Mus. Natl. Hist. Nat.*, Ser. 2, Vol. 40, No. 5, pp. 988-1018. [See also 194].
- 310.FOETTERLE F. (1856) Die Geologie von Süd-Amerika [The geology of South America]. *Mitt. Perthes Geogr. Anst.*, Vol. 2, pp. 187-192.
- 311.FORBES D. (1870) On volcanoes. *Geol. Mag.*, Vol. 7, pp. 314-328.
- 312.FOX J. P. (1956) Informe anual de la California Ecuador Petroleum Co. Unpublished report. [Not a very important report; at least one stratal unit of dubious stratigraphic value introduced.]
- 313.FRANCIS P. W., MOORBATH S. and THORPE R. S. (1977) Strontium isotope data for Recent andesites in Ecuador and north Chile. *Earth & Planet Sci. Lett.*, Vol. 37, No. 2, pp. 197-202.
- 314.FRANCO A. (1972a) Reseña/prognóstico (1971-1972). [Review/prediction (1971-1972)] *Pet. Petroquim. Int.*, Vol. 30, No. 3, pp. 22-23.
- 315.FRANCO A. (1972b) Qué traerá el Transecuatoriano. [What the Transecuatoriano (pipeline) will bring]. *Pet. Petroquim. Int.*, Vol. 30, No. 6, pp. 17-26.
- 316.FRANCO A. (1974) Latinoamérica: logros y metas. [Latin America: interests and goals]. *Pet. Petroquim. Int.*, Vol. 32, No. 3. [Ecuador; p. 14 (map), pp. 21-22]
- 317.FRANKLAND J. C. (1979) Los Tayos. *Descent. Wells*, Vol. 40, pp. 26-31. [A brief report, with map and photographs, of the results of the scientific expedition to these caves].
- 318.FREEMAN R. N. (1972) Petroleum geology of Subandean Basin of Ecuador, northern Perú and southern Colombia. [Abstract]. *Bull. Am. Assoc. Pet. Geol.*, Vol. 56, No. 3, pp. 617-618.
- 319.FREIDLAENDER I. (1931) El Reventador. Nachrichtendienst über vulkanische Ereignisse 1931. [Information concerning volcanic events 1931]. *Z. Vulkanol.*, No. 14, pp. 149-150.
- 320.FREY J. D. (1967) The San Eduardo Limestone in the Guayaquil area. *Rep. Anglo Ecuadorian Oilfields Ltd.*, No. J.D.F. 1. [Unpublished]. [An important regional study of the San Eduardo Limestone – see also 321, 572].
- 321.FREY J. D. and MILLS S. J. (1968) Geological investigations of southern border of the Colonche-Chongón Hills. *Rep. Anglo Ecuadorian Oilfields Ltd.*, No. J.D.F. 2, SJM 2. [Unpublished]. [A wider study embracing 320].
- 322.FRICK C. (1933) New remains of Trilophodont-Tetrabelodont Mastodons. *Bull. Am. Mus. Nat. Hist.*, Vol. 59, Artic. 9, pp. 505-602. [See also 427 for a synthesis of all the known Ecuadorian Pleistocene mammals].
- 323.FRICK C. (1937) *Horned ruminants of North America*. (New York). [See remarks for 322]
- 324.FUNKHOUSER J. W. (1951) Soil caves in tropical Ecuador. *Natl. Speleol. Soc. Am. News*, Vol. 9, No. 5, p.4.

G

325. GALLAGHER J. P. (1944) Generalized columnar stratigraphic section Río Esmeraldas-Colombian border area. Unpublished report of the International Ecuadorian Petroleum Co. [*Contains the earliest record of some of the stratal names still in use today*]
326. GALLOWAY J. J. and MORREY M. (1929) A lower Tertiary foraminiferal fauna from Manta Ecuador. *Bull. Am. Paleontol.*, Vol. 15, No. 55, pp. 1-56. [*The first systematic description of a microfauna from Ecuador. The incredibly rich and well-preserved material has subsequently been studied in 232, 236, 427, 571, 814, 851 and 886*].
327. GANSSER A. (1950) Geological and petrographical notes on Gorgone Island in relation to north-western South America. *Schweiz. Mineral. Petrogr. Mitt.*, Vol. 30, pp. 219-327.
328. GANSSER A. (1973) Facts and theories on the Andes. *J. Geol. Soc., London*, Vol. 129, pp. 93-131. [*A general paper with little of specific value about Ecuador*].
329. GARCÉS J. A. (1957) Las minas de Zaruma. Cuentas de la Real Hacienda 1561-1565. [The mines of Zaruma. Accounts of the Royal Hacienda 1561-1565]. *Dir. Mus. Hist. Dep. Munic. Educ. Cultura, Quito*, Vol. 27, pp. 1-416.
330. GARDNER F. J. (Editor) (1969) Oriente: the hottest new Latin oil patch in years. *Oil Gas J.*, Vol. 67, No. 12, pp. 63-66.
331. GARNER H. F. (1956) Southern Guayas Province. Unpublished geological report of the California Ecuador Petroleum Co. [*A not very important report, but contains some useful stratigraphical details*]
332. GENTLEY L. (1906) Análisis de las aguas minerales de Tesalia. [Analysis of the Tesalia mineral waters]. *An. Univ. Cent., Ecuador*, Vol. 22, pp. 148-149.
333. GERMAN PASCAL R. (1972) *Relación histórica del terremoto del 16 de Agosto de 1868 en Imbabura; heroica intervención del Dr. Gabriel García Moreno como jefe civil y militar de la provincia*. [Historic account of the Imbabura earthquake of August 16th 1868; heroic intervention of Dr. Gabriel García Moreno as civil and military chief to the province]. 34 pp. *Silvio Luis, Obispo de Ibarra, Ecuador*.
334. GERTH H. (1932-1941) *Geologie Südamerikas. Geologie der Erde*. [Geology of South America. Geology of the Earth]. I, 1932, pp. 1-199. [Ecuador, pp. 61-69]; II, 1935, pp. 201-389 [Ecuador, pp. 358-360]; III, 1941, pp. 391-614. (Berlin: Borntraeger). [*Many of the ages assigned to the various Formations are incorrect speculations*]
335. GERTH H. (1949) Die geologischen Verhältnisse des vernichtenden Erdbebens in Ecuador im August dieses Jahr (1949). [*The geological conditions of the destructive earthquake in Ecuador in August of this year (1949)*]. *Geol. Rundsch.*, Vol. 37, pp. 83-85.
336. GERTH H. (1951) Die Fortschritte der geologischen Forschung im Kordillerengebiet Südamerikas während und nach dem zweiten Weltkrieg. [The progress of geological research in the Cordillera of South America before and after the Second World War]. *Geol. Rundsch.*, Vol. 39, No. 1, pp. 255-273.
337. GERTH H. (1955) *Der geologische Bau der südamerikanischen Kordillere*. [The geological structure of the South American Cordillera]. (Berlin: Borntraeger).
338. GEYER O. F. (1974) Der Unterjura (Santiago Formation) von Ekuador. [The Lower Jurassic (Santiago Formation) of Ecuador]. *Neues Jahrb. Geol. Paläontol. Monatsh.*, Vol. 9, pp. 525-541.
339. GODING F. W. (1923) Petroleum development in Ecuador. *Commerce Rep., Washington*, July 1923.
340. GONZALO S. L. (1969) Ecuador. Pp. 164-165 in *Handbook of World salt resources*. LEFOND, S.J. (New York: Plenum Press).
341. GOOCH F. A. (1876) Über vulkanische Gesteine der Galapagos Inseln. [Concerning volcanic rocks on the Galápagos Islands]. *Mineral. Mitt.*, Vol. 6, pp. 133-140.
342. GOOSSENS P. J. (1968) La geología de la costa ecuatoriana entre Manta y Guayaquil. [The geology of the Ecuadorian coast between Manta and Guayaquil]. *Bol. Estud. Geol. Serv. Nac. Geol. Miner.*, No. 1, pp. 5-17. [*A rather confused stratigraphic concept put forward – see also 356 and 145 which clarifies the stratigraphy*].
343. GOOSSENS P. J. (1969a) Soil process for the formation of secondary residual barite deposits in Pascuales (Ecuador, South America). Symposium on remobilization of ores and minerals, Cagliari, Italy, pp. 273-281. [*See also 909*].
344. GOOSSENS P. J. (1969b) Structural control for the tholeiitic and alkalic lavas in Ecuador. [Abstract]. P. 162 in Symposium on volcanoes and their roots, Oxford, England. [*See also 342 and 356*].
345. GOOSSENS P. J. (1969c) Survey of metallic and non-metallic minerals. Technical report, Operation No. 5. San Bartolomé silver prospect, Azuay Province. *Rep. U.N. Dev. Programme*, No. PG/5. [Unpublished]. [*Published as 920*].
346. GOOSSENS P. J. (1969d) Survey of metallic and non-metallic minerals. Technical report, Operation No. 5. San Miguel molybdenite prospects, Cañar Province. Unpublished report for the U.N. Development Programme, Quito. [*See also 454 and 915*].
347. GOOSSENS P. J. (1970a) Importance de la tectonique transversale en Equateur. [Importance of the tectonic transversal in Ecuador]. International Upper Mantle Project, Conference on solid earth problems, Buenos Aires, Argentina, Vol. 2, p. 17.
348. GOOSSENS P. J. (1970b) The geology of Ecuador. Explanatory note for the geological map of the Republic of Ecuador. *Ann. Soc. Géol. Belg.*, Vol. 93, pp. 255-263. Spanish translation by SCHRECKINGER M. *Extrait Ann. Soc. Géol. Belg.*, Vol. 93, Part 2, pp. 1-9. [*Contains little of geological importance*].
349. GOOSSENS P. J. (1970c) À propos du 'volcanisme sédimentaire' dans la plaine côtière équatorienne (Amérique du Sud). [Concerning 'sedimentary volcanism' in the Ecuadorian coastal plains (South America)]. *Ann. Soc. Géol. Belg.*, Vol. 93, No. 1, pp. 149-153.
350. GOOSSENS P. J. (1972a) Metallogeny in Ecuadorian Andes. *Econ. Geol.*, Vol. 67, pp. 458-468.
351. GOOSSENS P. J. (1972b) An exhalative volcanic iron sulphide stratabound deposit near San Fernando, Azuay Province, Ecuador. *Econ. Geol.*, Vol. 67, pp. 469-480.
352. GOOSSENS P. J. (1972c) *Los yacimientos e indicios de los minerales metálicos y no metálicos de la República del Ecuador*. [Deposits and traces of metallic and non-metallic minerals of the Republic of Ecuador]. (Departamento de Geología, Universidad de Guayaquil). [*A useful compilation of all the known mineral deposits of Ecuador*].
353. GOOSSENS P. J. (1976) Lithologic, geochemical, and metallogenic belts in the northern Andes, and other structural relationships. *Trans. Soc. Min. Eng.*, Vol. 260, pp. 60-67.
354. GOOSSENS P. J. (1979) Cenozoic immature island arc and accreted oceanic crust in northwestern South America: a new ophiolite suite, in Ecuador, Colombia and Panamá. [Abstract]. International Ophiolite Symposium, Nicosia, Cyprus.

355. GOOSSENS P. J. and HOLLISTER V. F. (1973) Structural control and hydrothermal alteration pattern of Chaucha Porphyry Copper, Ecuador. *Miner. Deposita*, Vol. 8, pp. 321-331. [See also 901].
356. GOOSSENS P. J. and ROSE W. I. (1973) Chemical composition and age determination of tholeiitic rocks in the Basic Igneous Complex, Ecuador. *Bull. Geol. Soc. Am.*, Vol. 84, pp. 1043-1052. [Several radiometric dates (see 837) published in support of the confused stratigraphy of 342, but see 145].
357. GOOSSENS P. J., ROSE W. I. and FLORES D. (1977) Geochemistry of tholeiites of the Basic Igneous Complex of northwestern South America. *Bull. Geol. Soc. Am.*, Vol. 88, pp. 1711-1720.
358. GRAF K. (1976) Zur Mechanik von Frostmusterungsprozessen in Bolivien und Ecuador. [The mechanics of pattern-forming processes by frost in Bolivia and Ecuador]. *Z. Geomorphol.*, Vol. 20, No. 4, pp. 417-447.
359. GRAFFHAM A. A. (1956) Paleontologic report of the Progreso Basin of Ecuador with stratigraphic notes and paleontologic report on the I.E.P.C. Solano No. 1 Well. Unpublished geological report of the California Ecuador Petroleum Co. [Contains some useful stratigraphical details].
360. GRANJA J. C. (1942) *Nuestro Oriente*. [Our Oriente]. (Quito).
361. GRANJA V. J. C. (1964) Geología de la isla Genovesa (Tower). *Rev. Inst. Cienc. Nat. Univ. Centr., Ecuador*, Vol. 7, No. 1, pp. 21-25.
362. GRANJA V. J. C. (1968) Estudio sísmico geológico del terremoto de Alausí. [Geologic seismic study of the earthquake of Alausí]. *Bol. Estud. Geol., Serv. Nac. Geol. Miner., Quito*, Vol. 1, pp. 18-32.
363. GRANJA V. J. C. (1971) La geología y el coeficiente antisísmico, *Bol. Inf. Cienc. Nac., Quito*, Vol. 12, pp. 132-138.
364. GRANT U. S. and HERTLEIN L. G. (1938) The west American Cenozoic Echinoidea. *Univ. California Publ. Math. Phys. Sci.*, Vol. 2, pp. 1-225.
365. GRETZINGER W. (1928) Recent developments in Perú and Ecuador. *Oil Field Eng., New York*, Vol. 4, No. 6, pp. 22-24.
366. GRIM P. J. (1970) Connection of the Panamá fracture zone with the Galápagos rift zone, eastern tropical Pacific. *Marine Geophys. Res.*, Vol. 1, pp. 85-90.
367. GROSSMAN E., CARRIÓN J. and CARILLO O. (1970) Prospección de materiales radioactivos en el Ecuador. [Prospection of radioactive minerals in Ecuador]. *Politécnica*, Vol. 2, No. 1, pp. 141-153.
368. GROSSER P. (1905) Reisen in den ecuatorianischen Anden. [Travels in the Andes of Ecuador]. *Sitzungsber. Niederrheinischen Ges. Nat. Heilkd., Bonn.*, (1904), pt. A, pp. 6-16.
369. GRYS A. DE (1970) Copper and zinc in alluvial magnetites from central Ecuador. *Econ. Geol.*, Vol. 65, pp. 714-717.
370. GRYS A. DE, VERA J. and GOOSSENS P. (1970) A note on the hot springs of Ecuador. U.N. symposium on the development and utilization of geothermal resources, Italy.
371. GUBLER Y. and ORTYNSKI I. (1966) *Informe geológico preliminar sobre las posibilidades petroleras de las cuencas sedimentarias del Ecuador*. [Preliminary geological report on the petroleum possibilities of the sedimentary basins of Ecuador]. (Quito: Ministerio de Industrias y Comercio). [A not very important compilation, in part duplicating 188 for the coast, and adding little new information about the Andes and Oriente].
372. GUMOWSKA-WDOWIAK Z., MANECKI A., NAREBSKI W. and PAULO A. (1976) Mineralogical and chemical study of dacite from Quilotoa volcano in Ecuador. *Mineral. Polonica*, Vol. 5 (for 1974), pp. 3-19.
373. GUMOWSKA-WDOWIAK Z. (1977) Volcanism of Cotopaxi (Ecuador) in the light of study of plagioclases in its lavas. Part 1. Volcanic evolution and petrology of Cotopaxi (Ecuador). *Pr. Miner. Pol. Akad. Nauk.*, No. 55, 72pp. [See 658 Paulo and others, 1979 for part 2].
374. GURNEE R. H. (1967) The caves of Ecuador. *Nat. Speleol. Soc. Am. News*, Vol. 25, No. 5, pp. 94-97.

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375. HAGEN C. (1951) Geology of coastal Ecuador with reference to petroleum deposits [abstract]. *Bull. Geol. Soc. Am.*, Vol. 62, No. 12, Pt. 2, p. 1552; *Bull. Am. Assoc. Pet. Geol.*, 1952, Vol. 36, No. 5, p. 925; *Oil & Gas J.*, 1952, Vol. 50, No. 46, p. 170).
376. HAGGARD W. H. D. (1892) Ecuador; report on the mineral resources and new mining law of Ecuador. *Misc. Ser. Foreign Off., London*, No. 262, 11pp.
377. HALL M. L. (1977) *El volcanismo en el Ecuador*. [Volcanism in Ecuador]. 120 pp. (Quito: Instituto Panamericano de Historia y Geografía).
378. HALL M. and CALLE J. (1980) Geochronological control for the main tectonic-magmatic events of Ecuador. [Abstract]. *26th Int. Geol. Congr., Paris*, 1-7/7: 7/17, p. 47.
379. HALL M. L. and OTHERS (*In preparation*) Mapa geológico de la cuenca terciaria del Río Chota, Provincias de Imbabura y Carchi (1:25000) [Geological map of the Tertiary Basin of the Río Chota, provinces of Imbabura and Carchi (1:25000)]. (Quito: Escuela Politécnica Nacional).
380. HAM C. K. and HERRERA L. J. (1963) Role of Subandean fault system in tectonics of eastern Perú and Ecuador. Pp. 47-61 in Backbone of the Americas. *Mem. Am. Assoc. Pet. Geol.*, Vol. 2.
381. HANTKE G. (1939a) Übersicht über die vulkanische Tätigkeit vom Januar 1937 bis März 1938. [Summary of volcanic activity from January 1937 to March 1938]. *Z. Dtsch. Geol. Ges.*, Vol. 91, pp. 160-168. [*Ecuador*, p. 161].
382. HANTKE G. (1939b) Übersicht über die vulkanische Tätigkeit vom April bis Dezember 1938. [Summary of volcanic activity from April to December 1938]. *Z. Dtsch. Geol. Ges.*, Vol. 91, pp. 757-765- [*Ecuador*, p. 759].
383. HANTKE G. (1940) Übersicht über die vulkanische Tätigkeit 1939. [Summary of volcanic activity 1939]. *Z. Dtsch. Geol. Ges.*, Vol. 92, pp. 587-598. [*Ecuador*, p. 588].
384. HANTKE G. (1941) Übersicht über die vulkanische Tätigkeit 1940. [Summary of volcanic activity 1940]. *Z. Dtsch. Geol. Ges.*, Vol. 93, pp. 511-517. [*Ecuador*, p. 512].
385. HANTKE G. (1951) Übersicht über die vulkanische Tätigkeit 1941-1947. [Summary of volcanic activity 1941-1947]. *Bull. Volcanol.*, No. 2/11, pp. 161-208. [*Ecuador*, p. 173].
386. HANTKE G. (1953) Übersicht über die vulkanische Tätigkeit 1948-1950. [Summary of volcanic activity 1948-1950]. *Bull. Volcanol.*, No. 2/14, pp. 151-184. [*Ecuador*, p. 158].
387. HANTKE G. (1962) Übersicht über die vulkanische Tätigkeit 1957-1959. [Summary of volcanic activity 1957-1959]. *Bull. Volcanol.*, No. 2/11, pp. 161-208. [*Ecuador*, p. 173].
388. HANTKE G. and PARODI A. (1966) Catalogue of the active volcanoes of the world, including solfatara fields. Part XIX Colombia, Ecuador and Perú. *Int. Assoc. Volc., 1st. Geol. Applic. Rome*. [*Ecuador*, pp. 26-61].

389. HANZAWA S. (1947) Reinstatement of the genus *Heterosteginoides*, and the classification of the Miogypsinidae. *J. Paleontol.*, Vol. 21, No. 21, No. 3, pp. 260-263. [Discusses the *Miogypsinidae* of the San Pedro Sandstone].
390. HANZLIK J. (1968) Survey of metallic and non-metallic minerals. Termination report, summaries and detailed reports on geophysical investigations carried out at San Bartolomé, San Fernando, Ger and Cordocillo. *Rep. U.N. Dev. Programme, Quito*, No. JH/1. [Unpublished].
391. HARRINGTON H. J. (1962) Paleogeographical development of South America. *Bull. Am. Assoc. Pet. Geol.*, Vol. 46, pp. 1773-1814.
392. HASTENRATH S. (1976) Pleistocene and Recent glaciations in the high Andes of Ecuador. [Abstract]. *Am. Quat. Assoc., Natl. Conf.*, No. 4, p. 140.
393. HAWKESWORTH C. J., NORRY M. J., RODDICK J. C., BAKER P. E., FRANCIS P. W. and THORPE R. S. (1979) $^{143}\text{Nd}/^{144}\text{Nd}$, $^{87}\text{Sr}/^{86}\text{Sr}$, and incompatible element variations in calc-alkaline andesites and plateau lavas from South America. *Earth & Planet. Sci. Lett.*, Vol. 42, pp. 45-57.
394. HAYES D. E. (1966) A geophysical investigation of the Perú-Chile trench. *Marine Geol.*, No. 4, pp. 309-351.
395. HEARN L. T. (1950) El Chimborazo. *Bol. Inf. Cient. Nac., Quito*, No. 3, pp. 588-605.
396. HEATH J. A. (1965) Bibliography of reports resulting from U.S. Geological Survey participation in the United States technical assistance program, 1940-1965. *Bull. U.S. Geol. Surv.*, No. 1193, 51 pp. [Ecuador, p. 16].
397. HEINZ R. (1928) Beiträge zur Kenntnis der oberkretazischen *Inoceramen*. V, Über die Oberkreide-*Inoceramen* Südamerikas und ihre Beziehungen zu denen Europas und anderer Gebiete. [Contributions to the knowledge of the Upper Cretaceous *Inocerami*. V, concerning the Upper Chalk *Inocerami* of South America and their relationship to those of Europe and other areas]. *Mitt. Miner. Geol. Staatsinst.*, No. 10, pp. 41-97. [Includes details of *Inoceramus* found in the Cayo Formation of the coast].
398. HEMPLE W. (1914) Über die vulkanische Tätigkeit. [Summary of volcanic activity]. *Z. Vulkanol.*, Vol. 1, pp. 150-167. [Ecuador, pp. 155-156].
399. HENDERSON W. G. (1979) Cretaceous to Eocene volcanic arc activity in the Andes of northern Ecuador. *J. Geol. Soc., London*, Vol. 136, pp. 367-378.
400. HENDERSON W. G. and EVANS C. D. R. (1980) Ecuadorian subduction system: discussion [of Lonsdale, 1978]. *Bull. Am. Assoc. Pet. Geol.*, Vol. 64, No. 2, pp. 280-282.
401. HERBERT H. (1977) Die Grünschiefer der Ost-Kordillere Ecuadors und ihr metamorpher Rahmen. [The green schists of the Eastern Cordillera of Ecuador and their metamorphic structure] 190 pp. Doctoral dissertation, University of Tübingen, Western Germany.
402. HERBERT H. (1977) Petrochemie und Ausgangsmaterial von Grünschiefern aus der E-cordillere Ecuadors. [Petrochemistry and origin of the greenschists from the E-Cordillera of Ecuador]. *Fortschr. Mineral.*, Vol. 55, No. 1, pp. 55-46.
403. HERRERA M. (1918) Análisis del agua de la fuente de Guaschayacu. [Analysis of spring Waters of Guaschayacu]. *An. Univ. Cent., Ecuador.*, Vol. 5, pp. 78-84.
404. HERRON E. M. and HEIRTZLER J. R. (1967) Sea-floor spreading near the Galápagos. *Sci. New York*, Vol. 158, pp. 775-780.
405. HERRON E. M. (1972) Sea-floor spreading and the Cenozoic history of the east central Pacific. *Bull. Geol. Soc. Am.*, Vol. 83, pp. 1671-1691.
406. HERTLEIN L. G. (1972) Pliocene fossils from Baltra (South Seymour) Island, Galápagos Islands. *Proc. California Acad. Sci.*, Vol. 39, No. 3, pp. 25-46.
407. HERTLEIN L. G. and STRONG A. M. (1939) Marine Pleistocene mollusks from the Galápagos Islands. *Proc. California Acad. Sci.*, Ser. 4, Vol. 23, No. 24, pp. 367-380.
408. HERZ R. (1892) Die Gesteine der ecuatorianischen West-Cordillere von Pululagua bis Guagua-Pichincha. [The rocks in the Western Cordillera of Ecuador from Pululagua to Guagua Pichincha]. Inaugural dissertation University of Berlin. [Included in *Reiss and Stübel, 1892-1898*].
409. HEY R. N., DEFFEYES K. S., JOHNSON G. L. and LOWRIE A. (1972) The Galápagos Triple Junction and plate motion in the east Pacific. *Nature, London*, Vol. 237, pp. 20-22.
410. HEY R. N., JOHNSON G. L. and LOWRIE A. (1972) Recent apparent asymmetrical spreading near the Galápagos hot spot. [Abstract]. *EOS, Trans. Am. Geophys. Union*, Vol. 54, p. 244.
411. HEY R. N., JOHNSON G. L. and LOWRIE A. (1977) Recent plate motions in the Galápagos area. *Bull. Geol. Soc. Am.*, Vol. 88, pp. 1385-1403.
412. HIGGINS W. (1899) Estado de la industria minera en el Ecuador. [The state of the mining industry in Ecuador]. *Bol. Soc. Nac. Min. Santiago*, Vol. 16, pp. 310-312.
413. HILTERMANN H. (1974) *Rzehakina epigona* und Unterarten dieser Foraminifere. [*Rzehakina epigona* and subspecies of this foraminiferum]. *Paläontol. Z.*, Vol. 48, pp. 36-56. [Reviews the occurrence of *R. epigona* including those from the 'Palaeocene' of Ecuador].
414. HOERMANN P. K. and PICHLER H. (1979) Geochemistry petrology and origin of the Cenozoic volcanic rocks of the north Andes. *14th Pacific Science Congress, Khabarovsk*.
415. HOFFMAN R. A. and PAYNE C. M. (1975) In situ dynamic moduli determinations, Paute Dam Ecuador; a case history [abstract]. *Abstr. Assoc. Eng. Geol. Annu. Meet. Program*, No. 18, p. 28.
416. HOFFSTETTER R. (1948a) Sobre la presencia de un Camélido en el Pleistoceno Superior de la Costa ecuatoriana. [On the presence of a Camel in the Upper Pleistocene of coastal Ecuador]. *Bol. Inf. Cient. Nac. Quito*, Vol. 2, No. 5, pp. 23-25. [See 427].
417. HOFFSTETTER R. (1948b) Nota preliminar sobre los Edentata Xenarthra del Pleistoceno ecuatoriano. [Preliminary note on the Edentata Xenarthra of the Ecuadorian Pleistocene]. *Bol. Inf. Cient. Nac. Quito*, Vol. 2, Nos. 6-7, pp. 20-33. [See 427].
418. HOFFSTETTER R. (1948c) Notas sobre el Cuaternario de la Península de Santa Elena. I. Generalidades sobre la estratigrafía y Morfología. [Notes on the Quaternary of the Santa Elena Peninsula. I. Generalities on stratigraphy and morphology]. *Bol. Inf. Cient. Nac., Quito*, Vol. 2, Nos. 11-12, pp. 19-44.

419. HOFFSTETTER R. (1948d) Notas sobre el Cuaternario de la Península de Santa Elena. II, Pelecypoda del Tercer Tablazo. [Notes on the Quaternary of the Santa Elena Peninsula. 2, Pelecypods of the Third Tablazo]. *Bol. Inf. Cient. Nac., Quito*, Vol. 2, Nos. 13-14, pp. 67-83. [See also 99].
420. HOFFSTETTER R. (1949a) Nuevas observaciones sobre los Edentata del Pleistoceno superior de la Sierra ecuatoriana. [New observations on the Edentata of the Upper Pleistocene of the Ecuadorian Sierra]. *Bol. Inf. Cient. Nac., Quito*, Vol. 3, Nos. 20-21, pp. 67-69. [See 427].
421. HOFFSTETTER R. (1949b) Sobre los Megatheriidae del Pleistoceno del Ecuador. *Schaubia*, gen. nov. [On the Megatheriidae of the Pleistocene of Ecuador. *Schaubia*, gen. nov.] *Bol. Inf. Cient. Nac., Quito*, Vol. 3, No. 25, pp. 1-47. [See 427].
422. HOFFSTETTER R. (1949c) Les félins du pléistocène de l'Équateur ; I, faune actuelle et méthodes de comparaison. [The Pleistocene cats of Ecuador; 1, present-day fauna and methods of comparison]. *Trav. Inst. Fr. Étud. Andines*, Vol. 1, pp. 3-52. [See 427].
423. HOFFSTETTER R. (1950a) Algunas observaciones sobre los Caballos fósiles de la América del Sur. *Amerhippus* gen. nov. [Some observations on fossil horses of South America. *Amerhippus* gen. nov.] *Bol. Inf. Cient. Nac., Quito*, Vol. 3, Nos. 26-27, pp. 426-454. [See 427].
424. HOFFSTETTER R. (1950b) Observaciones sobre los Mastodontes de Sudamérica y especialmente del Ecuador. *Haplomastodon*, sub. gen. nov. de *Stegomastodon*. [Observations on the Mastodons of South America, especially of Ecuador. *Haplomastodon*, sub. gen. nov. of *Stegomastodon*]. *Publ. Esc. Politéc. Nac., Quito*, No. 1. [See 427].
425. HOFFSTETTER R. (1951) Informe sobre las investigaciones científicas realizadas durante una misión en el Ecuador (1946-1951). [Report on the scientific investigations completed during a mission in Ecuador (1946-1951)]. *Bol. Inf. Cient. Nac., Quito*, Vol. 4, No. 43, pp. 381-406.
426. HOFFSTETTER R. (1952a) Moluscos subfósiles de los estanques de sal de Salinas (Pen. De Santa Elena, Ecuador). [Molluscan subfossils of the salt ponds of Salinas (Santa Elena Peninsula, Ecuador)]. *Bol. Inst. Cient. Nac., Quito*, Vol. 1, No. 1, pp. 5-79. Reproduced in *Bol. Inf. Cient. Nac., Quito*, 1954, Vol. 7, No. 62, pp. 20-47; No. 63, pp. 137-170; No. 64, pp. 303-333; No. 65, pp. 399-426. Separate, 1954, (Quito: Casa de la Cultura Ecuatoriana).
427. HOFFSTETTER R. (1952b) Les mammifères pléistocènes de la République de l'Équateur. [The Pleistocene mammals of the Republic of Ecuador]. *Mém. Soc. Géol. Fr.*, Vol. 31, No. 66. [A very important synthesis of all the work on Ecuadorian Pleistocene mammals].
428. HOFFSTETTER R. (1952c) La antigüedad del Hombre americano. [The antiquity of American Man]. *Bol. Inf. Cient. Nac., Quito*, Vol. 4, No. 47, pp. 794-816.
429. HOFFSTETTER R. (1952d) Sobre los perros americanos Prehispánicos. [On the Pre-hispanic American dogs]. *Bol. Inf. Cient. Nac., Quito*, Vol. 5, No. 48, pp. 102-136.
430. HOFFSTETTER R. (1953) Sur la présence d'un Tatou géant du genre *Holmesina* dans le Pléistocène de l'Équateur (Amérique du Sud). [Concerning the presence of a giant Armadillo of the genus *Holmesina* in the Pleistocene of Ecuador (South America)]. *C. R. Séance Soc. Géol. Fr.*, No. 6, pp. 101-102.
431. HOFFSTETTER R. (1956) *Lexique Stratigraphique International*. Vol. 5, *Amérique Latine*, Pt. 5a, *Ecuador*. (Paris: Centre National de la Recherche Scientifique). [A very important synthesis of published and unpublished work with an extensive bibliography. Now completely revised and updated (see 149)].
432. HOFFSTETTER R. (1958a) Una serpiente marina del género *Pterosphenus* en el Eoceno Superior de Ancón (Ecuador de América). [A sea snake of the genus *Pterosphenus* in the Upper Eocene of Ancón (Ecuador)]. *Bol. Inf. Cient. Nac., Quito*, Vol. 10, No. 87, pp. 240-249.
433. HOFFSTETTER R. (1958b) Un serpent marin du genre *Pterosphenus* (*Pt. sheppardi* nov. sp.) dans l'Eocène supérieur de l'Équateur (Amérique du Sud). [A marine snake of the genus *Pterosphenus* (*Pt. sheppardi* nov. sp.) in the Upper Eocene of Ecuador (South America)] *Bull. Soc. Géol. Fr.*, Ser. 6, Vol. 8, No. 1, Pts. 1-5, pp. 45-50.
434. HOFFSTETTER R. (1970) Vertebrados cenozoicos del Ecuador. [Cenozoic vertebrates of Ecuador]. *Acta IV Congr. Lat. Am. Zool.*, Vol. 2, pp. 955-969.
435. HOFKER J. (1956) Tertiary foraminifera of coastal Ecuador: Part II, additional notes on Eocene species. *J. Paleontol.*, Vol. 30, pp. 891-958. [A sequel to 236].
436. HOFKER J. (1968) Tertiary foraminifera of coastal Ecuador. Lower Oligocene and Lower Miocene. *Palaeontographica*, Abt. A, Vol. 130, pp. 1-59. [A partial revision of 236 based on a re-examination of some of the samples].
437. HOFMAN E. (1948) *Manilkaroxylon diluviale* n. sp., ein fossiles Sapotaceenholz aus dem Quartär von Sta. Paula in Ecuador. [*Manilkaroxylon diluviale* n. sp., fossil wood from the Quaternary of Sta. Paula in Ecuador]. *Palaeobiologica*, Vol. 8, No. 3, pp. 280-282.
438. HOLDEN J. C. and DIETZ R. S. (1972) Galápagos Gore, NazCoPac Triple Junction and Carnegie-Cocos Ridges. *Nature, London*, Vol. 235, pp. 266-269.
439. HOLLISTER V. F. (1974) Regional characteristics of porphyry copper deposits of South America. *Trans. Am. Inst. Min. Met. Pet. Eng.*, Vol. 256, pp. 45-73.
440. HOLLOWAY H. L. (1932) Gold in Ecuador. *Min. Mag., London*, Vol. 46, No. 4, pp. 219-223.
441. HOLMES A. (1959) Geology of the Cayo Manglaralto, Colonche Area. Unpublished report of the California Ecuador Petroleum Co. [A general account, with a map, of the stratigraphy of this area; some new stratal terms introduced].
442. HOWARD K. A. and SIMKIN T. (1969) 1968 collapse of Fernandina caldera, Galápagos islands [Abstract]. *Eos (Trans. Am. Geophys. Union)*, Vol. 50, No. 4, p. 344.
443. HOYT D. V. (1978) An explosive volcanic eruption in the southern hemisphere in 1928. *Nature, London*, Vol. 275, pp. 630-632.
444. HRADECKÁ L., HRADECKÝ P., KRŮTA M., LYSENKO V., MLČOCH B. and PAULO A. (1974) *The geological exploration of the volcano Cotopaxi in Ecuador*. (Prague: Central Institute of Geology).
445. HRADECKÝ P. (1973) Sopky ecuadorských And a jejich aktivita. *Vesmír*, Vol. 52, No. 11, pp. 338-341.
446. HRADECKÝ P., MLČOCH B., KRŮTA M., HRADECKÁ L. and PAULO A. (1977) Geologický vývoj vulkánů Cotopaxi v ecuadorských Andách. *Sb. Geol. Véd.*, Vol. 29, pp. 7-31.
447. HUMBOLDT A. DE (1815-1831) *Voyage aux régions équinoxiales du nouveau continent, fait de 1799 à 1804*. [Voyages to equinoxial regions of the new continent, made in 1799 to 1804] (Paris). [Contains one of the earliest references (1823) to the Cuenca Basin].

448.HUMBOLDT A. DE (1823) *Essai géognostique sur le grisement des roches dans les deux hémisphères*. [Geological essay on the rock deposits in the two hemispheres] (Paris: Levrault). German edition by RITTER V.C.C. (Strasbourg: Levrault). [Contains one of the earliest references to the Cuenca Basin].

449.HUMBOLDT A. DE (1825) De quelques phénomènes physiques et géologiques qu'offrent les Cordillères des Andes de Quito et la partie occidentale de l'Himalaya. [Concerning some physical and geological phenomena which affect the Cordilleras of the Andes of Quito and the western part of the Himalayas]. *Ann. Sci. Nat.*, Vol. 4, pp. 225-253.

450.HUMBOLDT A. DE (1837-1838) Geognostische und physikalische Beobachtungen über die Vulkane des Hochlandes von Quito. [Geological and physical observations of the volcanoes in the highlands of Quito]. *Ann. Phys.*, Vol. 40, pp. 161-193; Vol. 44, pp. 193-219. French translation by LALANNE, L. *Ann. Mines. Paris*, 1839, Ser. 3, Vol. 16, pp. 411-452.

451.HUMBOLDT A. DE (1853) *Kleinere Schriften. Band 1. Geognostische und physikalische Erinnerungen, mit einem Atlas, enthaltend Umrisse von Vulkanen aus den Kordilleren von Quito und Mexico*. [Short papers. Vol. 1. Geological and physical recollections with an atlas, containing sketches of volcanoes in the Cordilleras from Quito and Mexico]. (Stuttgart and Tübingen: Cotta). [Includes the palaeontology of 172 in the account of the Cuenca Basin].

452.HUNT A. D. (1949) General summary of field work in the Colonche area. *Geol. Rep. Anglo Ecuadorian Oilfields Ltd.*, No. 49. [Unpublished]. [Many new stratal names of dubious stratigraphic value introduced here. The included map is very generalised and bears little resemblance to the maps of the DGM, Quito.]

453.HUNT A. D. (1950) The geology of the Colonche-Azúcar region. *Geol. Rep. Anglo Ecuadorian Oilfields Ltd.*, No. 51. [Unpublished]. [See remarks for 452].

454.HUSS F. and ŠKVOR V. (1971) Survey of metallic and non-metallic minerals. Geochemical, geological and geophysical investigations near San Miguel (Azogues). (Operation No. 5, Cañar Province). *Rep. U.N. Dev. Programme*, No. F.H./3. [Unpublished]. [This report was published as 834. See also 346].

455.HUTTI J. B. (1942) A mining tour of South America. *Eng. Min. J.*, Vol. 143, No. 6, pp. 47-51.

I

456.ISSCHOT C. VAN (1901) Les gîtes minéraux de l'Équateur. [The mineral deposits of Ecuador]. *Ann. Mines, Paris*, Ser. 9, Vol. 20, pp. 97-102. [Abstract. *Trans. Inst. Min. Eng.*, 1902-1903, Vol. 25, pp. 833-834]. [A resumé of the various economic mineral occurrences in Ecuador].

457.IWATA T. (1970) On the earthquake swarm in the Galápagos Islands region in June and July, 1968. *Bull. Tokyo Univ. Earthquake Res. Inst.*, Vol. 48, Pt. 5, pp. 935-993.

J

458.JACOBSEN Jr. P and NEFF C. H. (1972) Petroleum development in South America, Central America, and Caribbean area in 1971. *Bull. Am. Assoc. Pet. Geol.*, Vol. 56, No. 9, pp. 1602-1660. [Ecuador, pp. 1609-1611; 1630-1631].

459.JACOBSEN Jr. P and NEFF C. H. (1973) Petroleum development in South America, Central America and the Caribbean in 1972. *Bull. Am. Assoc. Pet. Geol.*, Vol. 57, No. 10, pp. 1868-1933. [Ecuador, pp. 1878-1880; map, p. 1922].

460.JACOBSEN Jr. P and NEFF C. H. (1974) Petroleum development in South America, Central America and Caribbean area in 1973. *Bull. Am. Assoc. Pet. Geol.*, Vol. 58, No. 9, pp. 1910-1973. [Ecuador, pp. 1920-1921; map, p. 1940].

461.JARRELL O. W. (1942) Operaciones de la Cotopaxi Exploration Co., Macuchi, Ecuador. [Operations of the Cotopaxi Exploration Co., Macuchi, Ecuador]. *Con. Panam. Ing. Minas. Geol., Santiago*, Vol. 4, pp. 1587-1597.

462.JARRIN A. (1974) Exploration and development of new hydrocarbon resources in Pacific basins of Ecuador [Abstract]. P. 1442 in Circum-Pacific Energy and Mineral Resources Conference. *Bull. Am. Assoc. Pet. Geol.*, Vol. 58, *Mem. Am. Assoc. Pet. Geol.*, No. 25 (1976), pp. 328-330.

463.JOHNSON G. L. and LOWRIE A. (1972) Cocos and Carnegie Ridges, result of the Galápagos 'hot spot'. *Earth & Planet. Sci. Lett.*, Vol. 14, pp. 279-280.

464.JOHNSTON J. F. W. (1838) On the composition of certain mineral substances of organic origin. VI, *Guayaquilite. Philos. Mag.*, Ser. 3, Vol. 13, pp. 329-333.

465.JONES G. (1856) On a shower of ashes over the plains of Quito. *Am. J. Sci.*, Vol. 23, pp. 276-278.

466.JOUYOVITCH [also ŽUJOVIĆ] J. (1880) *Note sur les roches éruptives et métamorphiques des Andes*. [Note on the igneous and metamorphic rocks of the Andes] (Belgrade).

467.JUTEAU T., MÉGARD F., RAHARISON L. and WHITECHURCH H. (1977) Les assemblages ophiolitiques de l'occident équatorien: nature pétrographique et position structurale. [The ophiolitic assemblages of western Ecuador: petrographic nature and structural position]. *Bull. Géol. Soc. Fr.*, Vol. 19, No. 5, pp. 1127-1132.

K

468.KANEPS A. G. (1973) Cenozoic planktonic foraminifera from the eastern equatorial Pacific Ocean. Pp. 713-745 in *Initial report of the deep-sea drilling project*, Vol. 16, (Washington, D.C.: U.S. Government Printing Office).

469.KARSTEN H. (1858) Über die geognostischen Verhältnisse des westlichen Colombien, der heutigen Republiken Neu-Granada und Ecuador. [Concerning the geology of western Colombia, the present republics of New Granada and Ecuador]. *Amtl. Ber. Versamml. Dtsch. Naturforsch. Aerzte*, pp. 80-117. Spanish translation. *Rev. Acad. Colomb. Cienc. Exactas Fis. Nat.*, 1947, Vol. 7, No. 27, pp. 361-381.

470.KARSTEN H. (1873) Über Lavaströme des Tunguragua und Cotopaxi. [Concerning the lava flows of Tunguragua and Cotopaxi]. *Z. Dtsch. Geol. Ges.*, Vol. 25, pp. 568-572.

471.KARSTEN H. (1886) *Géologie de l'ancienne Colombie bolivarienne, Venezuela, Nouvelle-Grenade et Ecuador*. [Geology of the ancient Bolivarian Colombia, Venezuela, New Granada and Ecuador]. (Berlin: Friedländer).

472.KEEN A. M. (1971) *Sea shells of tropical west America*. (California: Stanford University Press) [Contains information on the distribution of the modern fauna which is relevant to the Pleistocene fauna – see also 638].

473.KEHRER W. (1971) Die eozänen Konglomerate von San Lorenzo in Manabí (West-Ecuador) [The Eocene conglomerates of San Lorenzo in Manabí (western Ecuador)]. *Neues Jahrb. Geol. Paläontol. Monatsh.*, pp. 345-347.

- 474.KEHRER W. (1973) Über Konglomerathorizonte in den San Juan-Schichten und der Red Bed-Serie der Westkordillere Ecuadors. *Münster. Forsch. Geol. Paläontol.*, Vol. 31/32, pp. 261-269.
- 475.KEHRER W. and KAADEN G. VAN DER (1980) Notes on the geology of Ecuador with special reference to the Western Cordillera. *Geol. Jahrb. Ser. B*, Vol. 35, pp. 5-57.
- 476.KEHRER W. and KEHRER P. (1969a) Die oberkretazische San-Juan Formation der Westkordillere Ecuadors. [The Upper Cretaceous San-Juan Formation of the western Cordillera of Ecuador]. *Neues Jahrb. Geol. Paläontol. Abh.*, Vol. 133 No. 1, pp. 1-22. [A detailed account of the Maastrichtian San Juan (= Yunguilla) Formation along the San Juan-Guaranda road].
- 477.KEHRER W. and KEHRER P. (1969b) Beobachtungen zur Kreide/Tertiär-Grenze in Südwest-Ecuador. [Observations on the Cretaceous/Tertiary boundary in southwest Ecuador]. *Neues Jahrb. Geol. Paläontol. Abh.*, Vol. 134, pp. 131-147.
- 478.KENNERLEY J. B. (1971) Geology of the Llanganates area, Ecuador. Unpublished Report of the Institute of Geological Sciences (Overseas Division), London, No. 21, 13pp. [The first detailed account, with map, of the geology of this area]
- 479.KENNERLEY J. B. (1973) Geology of Loja Province. Unpublished report of the Institute of Geological Sciences (Overseas Division), London, No. 23. [An important detailed account (with 1:250000 map) of the geology of the Loja Province. Much of the mapping, with minor modifications and changes in names of some of the stratal units, subsequently published at 1:100000 scale by the DGGM].
- 480.KENNERLEY J. B. (1980) Outline of the geology of Ecuador. *Overseas Geol. & Miner. Resour.*, No. 55, 17pp.
- 481.KLAUTZSCH A. (1893a) Die Gesteine der ecuatorianischen West-Cordillere vom Río Hatuncama bis zur Cordillera de Llangagua. [The rocks of the western Cordillera in Ecuador from the Río Hatuncama to the Cordillera de Llangagua]. Inaugural dissertation University of Berlin. [Included in Reiss and Stübel, 1892-1898].
- 482.KLAUTZSCH A. (1893b) Die Gesteine der ecuatorianischen West-Cordillere von den Ambato-Bergen bis zum Azuay. [The rocks of the western Cordillera in Ecuador from the Ambato mountains to Azuay]. (Berlin: Asher). [Included in Reiss and Stübel, 1892-1898].
- 483.KLEPINGER L. L., KUHN J. K. and THOMAS J. Jr (1977) Prehistoric dental calculus gives evidence for coca in early coastal Ecuador. *Nature, London*, Vol. 269, No. 5628, pp. 506-507.
- 484.KLITGORD K. D. and MUDIE J. D. (1974) The Galápagos spreading centre: a near-bottom geophysical survey. *Geophys. J.R. Astron. Soc.*, Vol. 38, pp. 563-586.
- 485.KOELLING G. W. (1969) The mineral industry of other South American areas, *Miner. Yearb.* [Ecuador, pp. 841-844].
- 486.KRAMER H. R. (1963) Selected bibliography of South American geology. *Tulsa Geol. Soc. Dig.*, Vol. 31, Part 2-B, pp. 213-239. [Ecuador, p. 216. A very brief, haphazard selection of references relevant to Ecuador].
- 487.KROON T. P. (1969) Survey of metallic and non-metallic minerals. Geochemical prospection in Operation No. 5. Unpublished report of the U.N. Development Programme, Quito. [See also 908].
- 488.KROON T. P. and DE GRYS A. (1970) A geochemical drainage survey in central Ecuador. *Econ. Geol.*, Vol. 65, pp. 557-563.
- 489.KUMMEL B. (1948) Geological reconnaissance of the Contanama region, Perú. *Bull. Geol. Soc. Am.*, Vol. 59, pp. 1217-1266. [Contains some details about the southern Oriente of Ecuador].
- 490.KUMMEL B. (1950) Stratigraphic studies in northern Perú. *Am. J. Sci.*, Vol. 248, No. 4, pp. 249-263. [Contains an unsubstantiated reference to the presence of Triassic rocks in Ecuador].
- 491.KUMMEL B. and FUCHS R. L. (1953) The Triassic of South America. *Bol. Soc. Geol. Perú*, Vol. 26, pp. 95-119. [See remarks as for 490].

L

- 492.LA CONDAMINE C. M. DE (1751) *Journal du voyage fait par ordre du Roi à l'Equateur*. [Journal of a voyage made by the order of the King to Ecuador]. (Paris: Imp. Roy.). Reproduced in RUMAZO J. 1949. *Documentos para la historia de la Audiencia de Quito*. [Documents for the history of the Audiencia (local government) of Quito], Vol. 5, pp. 7-338. (Madrid: Aguado).
- 493.LACROIX A. (1911) Dumortierite de l'Equateur. *Bull. Soc. Fr. Mineral Crystallogr.*, Vol. 34, pp. 56-60.
- 494.LACROIX A. (1927) La constitution lithologique des îles volcaniques de la Polynésie australe. [The lithological composition of the volcanic islands of southern Polynesia]. *Mém. Acad. Sci. Inst. Fr.*, Vol. 59, pp. 1-82. [Galápagos Islands, pp. 67-69].
- 495.LANDES R. W. (1944a) Geología de la región sud-occidental del Ecuador. [Geology of the south-western region of Ecuador]. *Bol. Inst. Sudam. Pet.*, Vol. 1, No.3, pp. 191-200. [Several previously unpublished stratal names of the I.E.P.C. appear here – see also 496].
- 496.LANDES R. W. (1944b) Generalized columnar sections of Progreso Basin, southern Ecuador. Unpublished report of the International Ecuadorian Petroleum Co. [Appears to contain the first mention of several coastal stratal units which are still in use today – see also 495].
- 497.LARREA C. M. (1952) *Bibliografía científica del Ecuador; 2ª parte* [in Tome 2]: *Geología, Petrografía, Mineralogía, Paleontología, Vulcanología*. (Quito: Casa de la Cultura Ecuatoriana).
- 498.LARREA C. M. (1960a) *El Archipiélago de Colón (Galápagos)*. (Quito: Casa de la Cultura Ecuatoriana).
- 499.LARREA C. M. (1960b) Datos acerca de la antigüedad del Hombre en el Ecuador. [Information about the antiquity of Man in Ecuador]. *Bol. Inf. Cient. Nac. Quito*, Vol. 11, No. 92, pp. 150-163.
- 500.LARUELLE J., DE PAEPE P. and STOOPS G. (1964) Geologie de l'île Bartolomé. *Not Galápagos*, No. 4, pp. 8-11.
- 501.LEEDS A. R. (1977) Mantle velocities in the Colombia-Ecuador region. Pp. 237-242 in *Nariño; Proyecto cooperativo internacional, 1973; la transición océano-continente en el suroeste de Colombia*. RAMÍREZ J.E. and ALDRICH L.T. (Editors). (Bogotá: Instituto Geofísico, Universidad Javeriana).
- 502.LEGOV M. E. (1973) Der Meeresboden hebt die Anden. *Kosmos*, Vol. 69, No. 11, pp. 352-354.
- 503.LEMMONS R. S. (1912) Ecuador, the volcanic republic. *Travel*, Vol. 18, p. 17.
- 504.LEONARDOS O. H. (1957) Jazidas volcânicas de enxôfre da cordilheria dos Andes. [Volcanic deposits of sulphur in the Andean cordillera]. *Eng. Min. Metal.*, Vol. 25, No. 150, pp. 311-331.
- 505.LE VILLAIN G. (1930) État actuel de nos connaissances géologiques sur la République de l'Equateur. [The current state of our geological knowledge of the Republic of Ecuador]. *Bull. Mus. Natl. Hist. Nat., Paris*, Ser. 2, Vol. 2, No. 3, pp. 331-338. Spanish translation by MARTÍNEZ A. *An. Univ. Cent., Ecuador*, 1935, Vol. 55, No. 294, pp. 537-564.
- 506.LEVORSEN A. I. (1945) Geological map of South America; part 2: Foreword and explanation of legend. *Spec. Pap., Geol. Soc. Am.*, No. 61.
- 507.LEWIS G. E. (1950) El Sangay, fire-breathing giant of the Andes. *Natl. Geogr. Mag.*, Vol. 97, pp. 117-138; *El Universo, Guayaquil*, Vol. 13, pp. 4-5. [in Spanish].

508. LEWIS G. E. (1956) Galápagos Islands (Archipiélago de Colón) Province. Pp. 289-290 in Handbook of South American geology. *Mem. Geol. Soc. Am.*, Vol. 65.
509. LEWIS G. E., TSCHOPP H. J. and MARKS J. G. (1956) Ecuador. Pp. 251-288 in Handbook of South American geology. *Mem. Geol. Soc. Am.*, Vol. 65 [A condensed synthesis of previous published material with little new information]
510. LIDDLE R. A. and PALMER K. V. W. (1941) The geology and paleontology of the Cuenca-Azogues-Biblián region, provinces of Cañar and Azuay, Ecuador. *Bull. Am. Paleontol.*, Vol. 26, No. 100, pp. 357-418. [A detailed account of the stratigraphy of the Cuenca Basin, with a description of several new molluscs – see also 143, 543, 655 and 801].
511. LINDGREN W. (1917) Gold and silver deposits in North and South America. *Trans. Am. Inst. Min. Eng.*, Vol. 55, pp. 883-909. [Ecuador p. 894]; *Proc. 2nd Am. Sci. Congr.*, 1917, Vol. 8, pp. 560-576; *Annu. Rep. Smithsonian Inst. For 1917, 1919*, pp. 147-173. [Ecuador, pp. 162-163]. [Only a very general reference to the gold workings at Zaruma and Esmeraldas].
512. LOCK M. (1955) Geological report on the palaeontology of the Ancón area. *Rep. Anglo Ecuadorian Oilfields Ltd.* No. 66. [Unpublished]. [Contains little of stratigraphical or palaeontological importance].
513. LONGBOTTOM A. E. (1979) Miocene shark's teeth from Ecuador. *Bull. Br. Mus. Nat. Hist. (Geol.)*, Vol. 31, No. 5. [This is the first description of sharks teeth from Ecuador, and the fauna is the first accurately stratigraphically located shark fauna in South America].
514. LONSDALE P. (1978) Ecuadorian subduction system. *Bull. Am. Assoc. Pet. Geol.*, Vol. 62, pp. 2454-2477.
515. LONSDALE P. (1980) Ecuadorian subduction system: Reply [to Henderson and Evans, 1980]. *Bull. Am. Assoc. Pet. Geol.*, Vol. 64, pp. 280-282.
516. LONGO R. (1976) Perfil geológico estratigráfico de la Cordillera Occidental de los Andes Ecuatorianos, zona Alluriquín-Quito. [Stratigraphic profile of the Cordillera Occidental of the equatorial Andes in the Alluriquín-Quito region]. [Abstract]. *Congr. Latinoam. Geol. Resúmenes*, No. 3, p. 79.
517. LÓPEZ MENDIGUTIA F. (1911) Breve estudio minero-petrográfico de las rocas de los volcanes del Ecuador, donadas al Museo de Ciencias Naturales por el Barón de Humboldt. [Brief mineral-petrographic report of the rocks from Volcanoes of Ecuador, donated to the Museum of Natural Sciences by the Baron de Humboldt]. Thesis, Universidad Central de Madrid (Imp. Fortanet).
518. LORD R. F. (1892) The gold-fields of Ecuador. *Eng. Mag.*, Vol. 2, pp. 244-250.
519. LUPTON J. E., WEISS R. F. and CRAIG H. (1977) Mantle helium in hydrothermal plumes in the Galápagos Rift. *Nature, London*, Vol. 267, pp. 603-604.
520. LYSENKO V. (1975) Pseudokarst forms on Mt. Cotopaxi, Ecuador. *Cesk. Kras.*, Vol. 26, [for 1974], pp. 110-116 [in Czech].
- M**
521. MACDONALD K. C. and MUDIE J. D. (1974) Microearthquakes on the Galápagos spreading centre and the seismicity of fast-spreading ridges. *Geophys. J.R. Astron. Soc.*, Vol. 36, pp. 245-257.
522. MADDRELL R. J. (1973) The history of sediment yield and deposition of the Jubones River, Ecuador, and its relation to engineering projects. *Proc. Int. Assoc. Hydraul. Res. Int. Symp. River Mech., Bangkok*, Vol. 1, pp. 819-829.
523. MADDRELL R. J. (1974) The effects of crustal movement on a river control project in southern Ecuador [Abstract]. P. 302 in Cordilleran Section, 70th Annual Meeting. *Abstr. Geol. Soc. Am.*, Vol. 6, No. 3; *Conf. Pap., Seismol. Soc. Am. 69th Annu. Meeting, Las Vegas, 1974*, No. 370-3/29; 3/31.
524. MANCHENO E. (1973) Utilización de los recursos hídricos y su desarrollo en el Ecuador. [Utilisation of water resources and their development in Ecuador]. Pp. 479-481 in *Water for the human environments Vol. 2, Country reports; The Americas*. (edited by CHOW, V. T. and others). (Champaign, Illinois: International Water Resources Association).
525. MANCHENO G. E. (1952) Estudio geológico de Chalán. Thesis, Escuela Politécnica Nacional, Quito.
526. MANLEY E. C. (1957) Palaeontological investigation of well 1550. *Geol. Rep. Anglo Ecuadorian Oilfields Ltd.* No. 89. [Unpublished]. [Contains little of stratigraphical or palaeontological importance]
527. MAPA GEOLÓGICO DE LA REPÚBLICA DEL ECUADOR (1969) (Quito: Servicio Nacional de Geología y Minería) [The first detailed geological map of the country. Largely compiled from unpublished oil company maps, but incorporating some mapping of the coast by the D.G.G.M. at a scale of 1:50000]
528. MAPA ÍNDICE MINERALÓGICO REPÚBLICA DEL ECUADOR (1969) (Compiled by P.J. GOOSSENS) 1:1000000. (Quito: Ministerio de Industria y Comercio).
529. MARCHANT S. (1956a) The petroleum geology of S.W. Ecuador. *Proc. 20th Int. Geol. Congr., Mexico*, Vol. 4, pp. 65-88. [Some stratal names of south-west Ecuador first published here].
530. MARCHANT S. (1956b) Studies in the revision of the geology of the Ancón area – I. The section in the surface strata between the Santo Tomás and La Fe areas. *Geol. Rep. Anglo Ecuadorian Oilfields*, No. 67, [Unpublished].
531. MARCHANT S. (1956c) Studies in the revision of the geology of the Ancón area – II. Subsurface data from Borehole Fa 1, Wells, 1230, 1233 and 1550. *Geol. Rep. Anglo Ecuadorian Oilfields*, No. 68, [Unpublished]. [Includes the first reference to some of the coastal stratigraphic units].
532. MARCHANT S. (1957) Studies in the revision of the geology of the Ancón area – IV. Stratigraphical aspects of recent shallow cored holes. *Geol. Rep. Anglo Ecuadorian Oilfields*, No. 82, [Unpublished]. [Includes the first reference to some of the coastal stratigraphic units].
533. MARCHANT S. (1958) A note on stratigraphical nomenclature in S.W. Ecuador. *Geol. Rep. Anglo Ecuadorian Oilfields Ltd.*, No. 99, [Unpublished]. [A useful short glossary of the stratal terminology then in use in south-west Ecuador – see also 184].
534. MARCHANT S. (1961) A photogeological analysis of the structure of the western Guayas Province, Ecuador: with discussion of the stratigraphy and Tablazo Formation, derived from surface mapping. *Q. J. Geol. Soc., London*, Vol. 117, pp. 215-232. [The structure needs now to be interpreted in the light of 209].
535. MARCHANT S. (1965) Gravity slide deposits in the Timor and Ecuador. *Geol. Mag.*, Vol. 102, pp. 464-465. [Needs to be read in the light of 209].
536. MARCHANT S. and BLACK C. D. G. (1960) The nature of the Clay Pebble-beds and associated rocks of south-west Ecuador. *Q. J. Geol. Soc., London*, Vol. 115, pp. 317-338. [Needs to be read in the light of 209 – see also 90, 155, 178, 774, 778, 800, 806].
537. MARGERIE E. DE (1949) Alexandre de Humboldt et les volcans des Andes. *Ann Hébert Haugt*, Vol. 7, pp. 275-286.

538. MARKS J. G. (1946) Geology of the Tosagua area of Manabí Province. Unpublished report of the International Ecuadorian Petroleum Co. [A report of little stratigraphical value; one stratal unit (Charapotó Formation) which gained widespread recognition, introduced, but this has now been shown to have no stratigraphic value – see 146].
539. MARKS J. G. (1949a) Age of the Hannatoma fauna. *J. Paleontol.*, Vol. 23, No. 2, pp. 153-154. [A contribution to the debate on the age of the so-called Hannatoma fauna in Ecuador – see also 144, 633, 852 and 853].
540. MARKS J. G. (1949b) Nomenclatural units and tropical American Miocene species of the Gastropod family Cancellariidae. *J. Paleontol.*, Vol. 23, No. 5, pp. 453-464. [Several new species are described from Ecuador].
541. MARKS J. G. (1951) Miocene stratigraphy and paleontology of south-western Ecuador. *Bull. Am. Paleontol.*, Vol. 33, No. 139, pp. 271-433. [An important contribution to the stratigraphy and palaeontology of the Miocene of the Progreso and Daule basins – the stratigraphy of the latter being described for the first time – see also 148.].
542. MARKS J. G. (1956) Pacific coast geologic province (of Ecuador). Pp. 277-288 in Handbook of South American Geology. *Mem. Geol. Soc. Am.*, Vol. 65. [A synthesis of existing published and unpublished material, but containing little new information].
543. MARSHALL W. B. and BOWLES E. O. (1932) New fossil fresh-water mollusks from Ecuador. *Proc. U.S. Natl. Ms.*, Vol. 82, Artic. 5, No. 2946. [The first systematic description of fossils from the Miocene of the Cuenca-Basin – see also 143, 510, 655 and 801].
- MARSTERS see MASTERS (554)
544. MARTÍNEZ A. (1879) Ausbruch des Cotopaxi am 23 August 1878. [Eruption of Cotopaxi on 23 August 1878]. *Neues Jahrb. Mineral Geol. Palaeontol.*, pp. 57-58.
545. MARTÍNEZ A. N. (1902) El Pichincha. Estudios históricos, geológicos y topográficos. [Pichincha. Historical, geological and topographical studies]. *An. Univ. Cent. Ecuador*, Vol. 16, No. 118, pp. 379-386; No. 119, pp. 443-458; Vol. 17, No. 120, pp. 17-32; No. 121, pp. 95-110; No. 122, pp. 171-186; No. 123, pp. 265-280; No. 124, pp. 345-359; No. 125, pp. 473-480; Vol. 18, No. 126, pp. 9-24; No. 127, pp. 113-128; No. 128, pp. 209-227; No. 129, pp. 279-288.
546. MARTÍNEZ A. N. (1903-1905) El Tungurahua, contribuciones para su conocimiento geológico. [Tungurahua, contributions towards its geological understanding]. *An. Univ. Cent. Ecuador*, Vol. 19, No. 132, pp. 1-24; No. 133, pp. 73-77; No. 134, pp. 127-136; No. 135, pp. 205-219.
547. MARTÍNEZ A. N. (1905) Algunas montañas volcánicas de la Cordillera Oriental. [Some volcanic mountains of the Eastern Cordillera]. *An. Univ. Cent. Ecuador*, Vol. 20, pp. 33-49, 110-127, 155-168; Vol. 21, pp. 68-79. [Translation of 863].
548. MARTÍNEZ A. N. (1929-1933) Contribuciones para el conocimiento geológico de la región volcánica del Ecuador. [Contributions for the geological understanding of the volcanic region of Ecuador]. *An. Univ. Cent. Ecuador*, Vol. 43, No. 269, pp. 21-56; No. 270, pp. 491-554 [letters of Reiss]; Vol. 44, No. 271, pp. 73-134; Vol. 45, No. 273, pp. 21-54; No. 274, pp. 183-206; Vol. 46, No. 275, pp. 13-24; Vol. 47, No. 277, pp. 5-24; No. 278, pp. 367-502; Vol. 48, No. 279, pp. 85-124; No. 280, pp. 399-454; Vol. 49, No. 281, pp. 29-92; No. 282, pp. 357-384; Vol. 50, No. 283, pp. 192-222; No. 284, pp. 411-426.
549. MARTÍNEZ A. N. (1933) Las tres provincias australes del Ecuador (Loja, Azuay, Cañar) desde el punto de vista geológico. [The three southern provinces of Ecuador (Loja, Azuay, Cañar) from the geological point of view]. *An. Univ. Cent. Ecuador*, Vol. 51, No. 285, pp. 123-141. [Translation from the German of 832].
550. MARTÍNEZ A. N. (1933) El Metamorfismo y las rocas antiguas de la Cordillera Oriental del Ecuador. [Metamorphism and the ancient rocks of the Eastern Cordillera of Ecuador]. *An. Univ. Cent. Ecuador*, Vol. 51, No. 286, pp. 293-310. [Despite the title this is only a general summary of metamorphic processes and contains nothing about Ecuador].
551. MARTÍNEZ A. N. (1934) Sesenta años de recuerdos. El Dr. Teodoro Wolf. [Sixty years of recollections. Dr. Theodor Wolf]. *An. Univ. Cent. Ecuador*, Vol. 52, pp. 179-202.
552. MARTÍNEZ A. G. (1932) Las grandes erupciones del Tungurahua de los años 1918-1919. [The great eruptions of Tungurahua in the years 1918-1919] (Quito: Observatorio Geofísico).
553. MARTÍNEZ A. G. (1938) Exploraciones en los Andes Ecuatorianos. El Tungurahua [Explorations in the Ecuadorian Andes. Tungurahua] (Quito: Observatorio Astronómico Meteorológico, Sección Geofísico).
554. MASTERS V. G. (1923) Oil resources of Ecuador. *Trans. Am. Inst. Min. Metall. Eng.*, Vol. 68, pp. 1032-1037.
555. MAYERS N. (1954) Ecuador: economic and commercial conditions in Ecuador. Overseas Economic Surveys Board of Trade (London: HMSO).
556. MCBIRNEY A. R. and AOKI K. (1966) Petrology of the Galápagos Islands. In Bowman, R.I. 1966.
557. MCBIRNEY A. R. and WILLIAMS H. (1969) Geology and petrology of the Galápagos Islands. In Bowman, R.I. 1966.
558. McCASLIN J. C. (1975) Oriente a vast storehouse of oil. *Oil Gas J.*, Tulsa, No. 73/15, p. 113.
559. McLAUGHLIN D. H. (1956) Geology of the south-western side of the Progreso Basin, Guayas Prov., Ecuador. Unpublished report of the California Ecuador Petroleum Co. [Contains some useful stratigraphical information].
560. MENA L. E., MOLINA C. and SALAZAR P. (1959) Breve historia de los principales terremotos en el Ecuador, 1534-1958. [Brief history of the main earthquakes in Ecuador, 1534-1958] (Quito: Observatorio Astronómico).
561. MENARD H. W., CHASE T. E. and SMITH S. M. (1964) Galápagos Rise in the southeastern Pacific. *Deep-Sea Res.*, Vol. 11, pp. 233-242.
562. MERCER J. W. (1903) Gold mining and milling in Ecuador. *Eng. Min. J.*, Vol. 76, pp. 233-235
563. MERCER J. W. (1916) Mining in Ecuador. *Eng. Min. J.*, Vol. 101, pp. 343-346; *Min. Sci. Press*, Vol. 112, pp. 161-165; *Proc. 2nd Panam. Sci. Congr.*, 1917, Vol. 8, pp. 201-208.
564. MERRILL G. P. (1893) Report upon rocks collected from the Galápagos Islands. *Bull. Mus. Comp. Zool., Harvard*, Vol. 16, pp. 235-237.

565. MEYER H. (1907) *In den Hoch-Anden von Ecuador, Chimborazo, Cotopaxi, etc. Reisen und Studien*. [In the High Andes of Ecuador, Chimborazo, Cotopaxi, etc.....journeys and studies]. (Berlin: Reimer) Spanish translation by GUERRERO J. *An. Univ. Cent., Ecuador*, 1938-1939. Vol. 60, No. 304, pp. 779-915; Vol. 61, No. 305, pp. 183-394; No. 306, pp. 1363-1569; Vol. 62, No. 307, pp. 7-70; also published as a separate vol., 1938-1940.
566. MICHEL R. C. (1923) *Report on the economic and financial conditions in Ecuador*. Department of Overseas Trade (London: HMSO).
567. MICHELS J. W. (1969) Testing stratigraphy and artifact reuse through obsidian hydration dating. *Am. Antiq., Salt Lake City*, Vol. 34, pp. 15-22.
568. MILLER A. K. (1947) Tertiary nautiloids of the Americas. *Mem. Geol. Soc. Am.*, Vol. 23, 234pp. [*The nautiloid Aturia curvilineata Miller & Thompson recorded from the Progreso Basin – see also 144*].
569. MILLER C. P., MULLINEAUX D. R. and HALL M. L. (1978) Reconnaissance map of potential volcanic hazards from Cotopaxi Volcano, Ecuador. *Misc. Invest. Ser., U.S. Geol. Surv.*, No. 1-1072.
570. MILLER B. L. and SINGEWALD J. T. Jr. (1919) The mineral deposits of South America (New York: McGraw-Hill) (London: Hill Publishing Co.) [*Ecuador, pp. 400-414*].
571. MILLS S. J. (1967) Tertiary stratigraphy in coastal Ecuador. The stratigraphy of the Tertiary rocks of southern Manabí and Guayas Provinces (excluding the Santa Elena Peninsula) with notes on Esmeraldas Province, Ecuador. *Rep. Anglo Ecuadorian Oilfields Ltd.*, No. S.J.M.L., [Unpublished]. [*An important, carefully thought and documented stratigraphical and palaeontological report*].
572. MILLS S. J. (1968) The micropalaeontology of the San Eduardo Limestone and associated stratigraphical units. *Palaeontol. Note Anglo Ecuadorian Oilfields Ltd., Ecuador*. No. 1. [Unpublished]. [*An important account of the micropalaeontology of both the limestone and intercalated shale beds of the San Eduardo Limestone – see also 97, 188, 320, 834, 851, 927*].
573. MINING ANNUAL REVIEW [*Each year a brief summary of the mining activity in Ecuador is published*].
574. MIRO M. DE., AYON H. and BENITES B. (1976) *Morfología y estructura del margen continental del Ecuador*. [Morphology and structure of the continental margin of Ecuador]. (Guayaquil: Instituto Oceanográfico Armada)
575. MIYAKE T. (1974) Characteristics of Chaucha porphyry copper deposits, Ecuador. *Min. Geol. Tokyo*, Vol. 24, Pt. 2, No. 124 pp. 129-135. [In Japanese, English summary]
576. MOLNAR P. and SYKES L. R. (1969) Tectonics of the Caribbean and Middle America regions from focal mechanisms and seismicity. *Bull. Geol. Soc. Am.*, Vol. 80, pp. 1639-1684.
577. MONTORIOL-POUS J. and DEMIER J. (1977) Contribución al conocimiento volcano-espeleológico de la isla de Santa Cruz. (Galápagos, Ecuador). *Espeleon.*, Esp., No. 23, pp. 75-91
578. MOORE E. L. (1944) Resumen de una charla sobre la geología de la Península de Santa Elena. [Resumé of a discussion on the geology of the Santa Elena Peninsula]. Bulletin of the Instituto Sudamericano de Petróleo, Sector Ecuatoriana.
579. MOORE W. S. and VOGT P. R. (1976) Hydrothermal manganese crusts from two sites near the Galápagos Spreading Axis. *Earth & Planet. Sci. Lett.*, Vol. 29, No. 2, pp. 349-359.
580. MOORE E. L. and WALLS R. (1942) Geological reconnaissance of part of the El Oro Province, Ecuador. *Geol. Rep. Anglo Ecuadorian Oilfields Ltd.* No. 43. [Unpublished]. [*A report of little stratigraphic value about a little-known area of Ecuador. An intriguing reference to fossiliferous strata of 'pre-Tertiary age' (quoted in 149, p.228)*].
581. MOORE R. T. (1950) The first ascent of El Sangay. *Nat. Hist., New York*, Vol. 59, pp. 216-221; 238-239; 272-277.
582. MORENO G. G. (1858) Exploration of the volcano of Pichincha. *Am. J. Sci.*, Ser. 2, Vol. 26, pp. 408-411.
583. MORENO N. V. (1973) Forestry, geology and hydrological investigations from ERTS-I imagery in two areas of Ecuador, South America. (Quito: Junta Nacional de Planificación).
584. MORITA K. and HIGUCHI Y. (1978) Significant features of oil occurrence in the Oriente Basin, South America. *J. Jap. Assoc. Pet. Technol.*, Vol. 43, No. 2, pp. 79-88.
585. MORGAN W. J. (1971) Convection plumes in the lower mantle. *Nature, London*, Vol. 230, pp. 42-43.
586. MORGAN W. J. (1972) Deep mantle convection plumes and plate motions. *Bull. Am. Assoc. Pet. Geol.*, Vol. 56, pp. 203-213.
587. MOSER H. and STICHLER W. (1975) Use of environmental isotope methods as a reconnaissance tool in groundwater exploration near San Antonio de Pichincha, Ecuador. *Water Resour. Res., Washington, D.C.*, Vol. 11,
588. MOSQUERA C. F. (1949) Viaje de reconocimiento y estudio por el río Santiago (Prov. de Esmeraldas). [Reconnaissance trip and study of the Santiago River (Esmeraldas Province)]. *Bol. Inf. Cient. Nac., Quito*, Vol. 2, Nos. 18-19. [*Some of the names introduced by the IEPC were first published here. Includes a map based on I.E.P.C. maps – see also 589*].
589. MOSQUERA C. F. (1950a) Viaje de reconocimiento y estudio por el río Mira, río San Juan o 'Mayasquer' y río Camumbi de las provincias de Esmeraldas y Carchi en la frontera con Colombia. [Reconnaissance and study trip of the Mira River, San Juan or 'Mayasquer' River and the Camumbi River of the Esmeraldas and Carchi provinces in the frontier with Colombia]. *Bol. Inf. Cient. Nac., Quito*, Vol. 3, Nos. 26-27, pp. 502-516. [*See remarks as for 588*].
590. MOSQUERA C. F. (1950b) Los yacimientos carboníferos de la provincia del Cañar. [The carboniferous deposits of the Cañar province]. *Bol. Inf. Cient. Nac., Quito*, Vol. 3, No. 35, pp. 321-355. [*See also 49, 110, 591, 648, 681, 722, 804, 904, 982*].
591. MOSQUERA C. F. (1951a) Posibilidades de la utilización del carbón de Biblián. Condiciones de su explotación. [Possibilities for the utilisation of the coal from Biblián. Conditions of its exploitation]. *Bol. Inf. Cient. Nac., Quito*, Vol. 3, No. 38, pp. 631-635. [*See also 649*].
592. MOSQUERA C. F. (1951b) Estudio geológico-económico de las minas de la Calera Exploration Co. y de la South American Development Co. en relación con la anunciada cesación de los trabajos de explotación. [Geological-economic study of the mines of the Calera Exploration Co. and the South American Development Co. in relation to the announced cessation of exploitation]. *Bol. Inf. Cient. Nac., Quito*, Vol. 3, No. 39, pp. 667-684.
593. MOSQUERA C. F. (1951c) Las minas de Portovelo. *An. Univ. Cuenca*, Vol. 7, No. 4.
594. MOSQUERA C. F. (1952a) Yacimientos de azufre en el Ecuador. [Sulphur deposits of Ecuador]. *An. Univ. Cuenca*, Vol. 8, No. 2, pp. 147-151.

595. MOSQUERA C. F. (1952b) Yacimientos de azufre de Tixán. [The sulphur deposits of Tixán]. *Bol. Inf. Cient. Nac., Quito*, Vol. 5, No. 52.
596. MOSQUERA C. F. (1959) Dos estudios sobre nuestra geología. I. Estudio geológico de los hundimientos y deslizamientos de los terrenos encima de la línea del Ferrocarril G. & Q. y de la Carretera Panamericana, y a 4 kilómetros al norte de Alausí, Provincia del Chimborazo. II. Estudio geológico de las Minas de Mármol y Yacimientos de Carbonato de Calcio de Zula, Parroquia Achupallas, Cantón Alausí, Provincia del Chimborazo. [Two studies on our geology. I. Geological study of the landslips above the G. & Q. railway line and the Panamerican Highway, and at 4 kilometres to the north of Alausí, Province of Chimborazo. II. Geological study of the marble mines and calcium carbonate deposits of Zula, Achupallas Parish, Cantón Alausí, Province of Chimborazo]. *Bol. Inf. Cient. Nac., Quito*, Vol. 10, No. 89, pp. 93-99; 100-105.
597. MOSQUERA C. F. (1954) Reseña de la industria minera en el Ecuador para 1953. [Review of the mining industry in Ecuador for 1953]. *Bol. Inf. Cient. Nac., Quito*, Vol. 7, No. 64, pp. 268-271.
598. MOSQUERA C. F. (1955) *Los yacimientos de yeso de las provincias del Sur*. [Deposits of gypsum of the provinces of the south]. *Bol. Inf. Cient. Nac., Quito*, Vol. 7, No. 69; pp. 787-804.
599. MOSQUERA C. F. (1956) Los yacimientos de yeso de las Provincias del Sur. [Deposits of gypsum of the provinces of the south]. (Quito: Dirección General de Geología e Hidrocarburos).
600. MOSQUERA C. F. (1958) Aspectos geológicos de los sismos de Esmeraldas; estudios efectuados después de los terremotos del 19 de enero, temblores del 1° de febrero y terremotos del 15 de abril 1958. [Geological aspects of the earthquake shocks of Esmeraldas; studies taken after the earthquakes of 19th January, the tremors of 1st February and the earthquakes of 15th April 1958]. *Bol. Inf. Cient. Nac., Quito*, Vol. 10, No. 88, pp. 355-367.
601. MOSQUERA C. F. (1968) Investigaciones geológicas en el cuadrángulo de Sigsig (Provincia del Azuay). [Geological investigations in the Sigsig quadrangle, Azuay Province]. *An. Univ. Cent., Ecuador*, Vol. 96, No. 351, pp. 193-211.
602. MOSQUERA C. F. (1969) Conocimiento actual de los recursos mineros e hidrocarburos del país (1). [Present day knowledge of the mineral and hydrocarbon resources of the country (1)]. *Flora, Quito*, Vol. 13, Nos. 47-50.
603. MOSQUERA C. F. (1974) Mineral resources of Ecuador – Development and prospects. P. 1451 in Circum-Pacific Energy and Mineral Resources Conference. [Abstract], *Bull. Am. Assoc. Pet. Geol.*, Vol. 58, Pt. 2; *Mem. Am. Assoc. Pet. Geol.*, No. 25 (1976, pp. 552-555).
604. MOSQUERA C. F. and CIFUENTES J. (1955) Informe de la Comisión Especial de Promotores de Industrias Guapán S.A. sobre las posibilidades de instalación de una fábrica de cemento en Guapán, Azogues, Prov. de Cañar. [Report of the special commission of 'Industria Guapán S.A.', on the possibilities of the installation of a cement factory in Guapán, Azogues, Cañar province]. *An. Univ. Cuenca*, Vol. 11, Nos. 3-4, pp. 467-488.
605. MÜLLER-KAHLE E. (1968) Survey of metallic and non-metallic minerals. Informe geológico preliminar sobre el depósito de cobre-molibdeno en Chaucha. [Preliminary geological report on the copper-molybdenum deposit of Chaucha]. Unpublished report of the U.N. Development Programme. [See also 609, 901].
606. MÜLLER-KAHLE E. (1971a) Survey of metallic and non-metallic minerals. Systematic geochemical exploration of Operation No. 8. *Rep. U.N. Dev. Programme*, No. EMK/6.
607. MÜLLER-KAHLE E. (1971b) Survey of metallic and non-metallic minerals. Geologic-geochemical investigation of anomaly 8-13, Río Catamayo (Operation No. 8, Loja Province). *Rep. U.N. Dev. Programme*, No. EMK/7.
608. MÜLLER-KAHLE E. and DAMON P. E. (1970) K-Ar age of biotite granodiorite associated with primary Cu-Mo mineralization at Chaucha, Ecuador. In Damon, P.E. 1970. [A similar radiometric age determination was given earlier in 837].
609. MÜLLER-KAHLE E. and DAMON P. E. (1972) Geochemische Untersuchungen am 'porphyry copper' deposit of Chaucha, Ekuador. [Geochemical research on the 'porphyry cooper' deposit of Chaucha, Ecuador]. *Z. Erzbergbau Metallhüttenwes.*, Vol. 25, pp. 275-281. [See also 605, 901].
610. MULLINEAUX D. R., MILLER C.D. and HARLOW D. (1976) Reconnaissance study of volcanic hazards of Cotopaxi Volcano, Ecuador. *Open File Rep. U.S. Geol. Surv.*, No. 76/799, 20pp. [See also 67].
611. MUÑOZ J. E. (1949) *Aguas minerales del Ecuador y nociones de hidrología general*. [Mineral waters of Ecuador and ideas of general hydrology]. (Quito: Talleres Gráficas Nacionales).
612. MUÑOZ J. E. (1955) Nuevas notas sobre hidrología de la Provincia de Pichincha. [New notes on the hydrology of the Pichincha Province]. *Bol. Inf. Cient. Nac. Quito*, Vol. 7, No. 69, pp. 824-829.
613. MUÑOZ J. E. (1956) El agua sulfurosa de Guangopolo. [The sulphurous waters of Guangopolo]. *Bol. Inf. Cient. Nac. Quito*, Vol. 8, No. 76, pp. 715-722.
614. MUÑOZ J. E. (1957) *Guía de las aguas minerales del Ecuador*. [Guide to the mineral Waters of Ecuador]. (Quito: Santo Domingo).
615. MURRAY A. J. R. (1923) Report on the geology of the S. Elena Peninsula, Ecuador. Part III. Geology of the country around the Ancon Field. *Geol. Rep. Anglo Ecuadorian Oilfields Ltd.*, No. 7. [Unpublished]. [Some of the coastal stratigraphical names (*Seca Shales, Socorro 'Shale'*) still in use were introduced here – see also 616, 617].
616. MURRAY A. J. R. (1924) Notes on the geology of the Ancón Field, Part II. *Geol. Rep. Anglo Ecuadorian Oilfields Ltd.*, No. 9. [Unpublished]. [See also 615, 617].
617. MURRAY A. J. R. (1925) A report on the southern property of the A.E.O. Ltd. and adjacent territory. *Geol. Rep. Anglo Ecuadorian Oilfields Ltd.*, No. 11. [Unpublished]. [See also 615, 616].
618. MURRAY S., CONLON D., SIRIPONG A. and SANTORO J. (1975) Circulation and salinity distribution in the Río Guayas Estuary, Ecuador. *Estuarine Res.*, Vol. 2 (*Proc. 2nd Int. Estuarine Conf. South Carolina, Oct 1973*, CRONIN, L.E. (Editor)), pp. 345-636.

N

619. NAREBSKI W. and PAULO A. (1973) Solfataric alteration products of andesitic lavas in the crater of Cotopaxi volcano, Ecuador. *Mineral. Polonica*, Vol. 4, pp. 67-87.
620. NEALE E. St J. (1866) On the discovery of new gold deposits in the districts of Esmeraldas, Ecuador. *Q. J. Geol. Soc., London*, Vol. 22, pp. 593-594.
621. NEFF C. H. (1970) Review of 1969 petroleum developments in South America, Central America and Caribbean area. *Bull. Am. Assoc. Pet. Geol.*, Vol. 54, No. 8, pp. 1342-1406. [Ecuador, pp. 1374-1376].
622. NEFF C. H. (1971) Review of 1970 petroleum development in South America, Central America and Caribbean area. *Bull. Am. Assoc. Pet. Geol.*, Vol. 55, No. 9, pp. 1418-1482. [Ecuador, pp. 1452-1455].

623. NIETHAMMER J. (1964) Contribution à la connaissance des mammifères terrestres de L'Île Indefatigable (= Sta. Cruz), Galápagos, résultats de l'expédition allemande aux Galapagos 1962/1963. [Contributions to the knowledge of terrestrial mammals of Indefatigable Island (= Sta. Cruz), Galápagos, results of the German expedition to the Galápagos 1962/1963]. *Mammalia*, No. 28, pp. 593-606.
624. NOIREL H. (1925) Déterminations de l'intensité de la pesanteur faites dans la République de l'Équateur au cours de la Misi3n de Service Géographique de l'Armée (1899-1906). [Gravity determinations in the Republic of Ecuador during the mission of the Army Geographical Service (1899-1906)]. *C.R. Hebd. Séances Acad. Sci., Paris*, Vol. 180, No. 22, pp. 1650-1653.
625. NORDLIE B. E. (1973) Morphology and structure of the western Galápagos volcanoes and a model for their origin. *Bull. Geol. Soc. Am.*, Vol. 84, pp. 2931-2956.
626. NORDLIE B. E. and COLONY W. E. (1973) A fumarole with periodic fountaining, Volcán Alcedo, Galápagos Islands. *Bull. Geol. Soc. Am.*, Vol. 84, pp. 1709-1720.
627. NUÑEZ DEL ARCO E. (1967) Survey of metallic and non-metallic minerals. Operation No. 3, reporte concluyente. Unpublished report of the U.N. Development Programme, Quito. [See also 906].
628. NUÑEZ DEL ARCO E. (1971) *Yacimiento de bentonita de Charasol, Provincia del Cañar, Ecuador*. [Bentonite deposit of Charasol, Province of Cañar, Ecuador]. (Quito: Dirección General de Geología y Minas). [One of the few documented occurrences of bentonite in Ecuador].
629. NYGREN W. E. (1950a) Bolívar Geosyncline of northwestern South America. *Bull. Am. Assoc. Pet. Geol.*, Vol. 34, No. 10, pp. 1998-2006.
- O**
630. OJEDA R. V. (1918) Estudios geológicos. [Geological studies]. *An. Univ. Cent. Ecuador*, Vol. 5, pp. 263-301.
631. OKABAYASHI I. and ARAI K. (1979) Problems of foundation for the refinery on the expansive soil and its treatment; Ecuador. [in Japanese, English summary]. *Tsuchi-To-Kiso*, Vol. 27, No. 1, pp. 47-56.
632. OLSSON A. A. (1924) Notes on marine mollusks from Perú and Ecuador. *Nautilus*, Vol. 37, pp. 120-130. [Records recent molluscs (p. 122), including material from burial sites, on the Santa Elena Peninsula].
633. OLSSON A. A. (1931) Contributions to Tertiary paleontology of northern Perú. Part 4, The Peruvian Oligocene. *Bull. Am. Paleontol.*, Vol. 17, No. 63, pp. 100-264. [Contains important references to the 'Oligocene' (Miocene) of Ecuador, and was the start of the Hannatoma fauna controversy there – see also 144, 539, 852 and 853].
634. OLSSON A. A. (1932) Contributions to the Tertiary paleontology of northern Perú. Part 5, The Peruvian Miocene. *Bull. Am. Paleontol.*, Vol. 19, No. 68, pp. 5-216. [Contains references of the Eocene and Miocene of Ecuador].
635. OLSSON A. A. (1939) Introduction à la géologie du nord-ouest du Pérou et du sud-ouest de l'Équateur. [Introduction to the geology of north-west Perú and south-west Ecuador]. *Ann. Off. Natl. Combust. Liq.*, Vol. 14, No. 3, pp. 551-604. [Several stratigraphical names in common use were first introduced here; stratigraphy somewhat confused].
636. OLSSON A. A. (1942a) Tertiary deposits of northwestern South America and Panama. *Proc. 8th Am. Sci. Congr., Washington*, Vol. 4, pp. 231-287. [Ecuador pp. 253-265. Several stratigraphical names in common use were first introduced here; stratigraphy somewhat confused].
637. OLSSON A. A. (1942b) Some tectonic interpretations of the geology of northwestern South America. *Proc. 8th. Am. Sci. Congr. Washington*, Vol. 4, pp. 401-416.
638. OLSSON A. A. (1961) *Mollusks of the tropical eastern Pacific, particularly from the southern half of the Panamic-Pacific faunal province (Panama to Perú)*. Panamic Pacific pelecypoda. (Ithaca: Paleontological Research Institute). [The first documentation of the recent marine molluscs of coastal Ecuador – see also 639].
639. OLSSON A. A. (1964) *Neogene molluscs from northwestern Ecuador*. (Ithaca: Paleontological Research Institute). [Important paper describing the molluscs of a little-known area of Ecuador; stratigraphy somewhat confused – see 148].
640. OLSSON A. A. and PILSBRY H. A. (1949) *Balanus* in the Oligocene of northern Perú and western Ecuador. *Soc. Geol. Perú., Vol. Jubilar*, Pt. 2, Fasc. 16, pp. 1-5.
641. OPPENHEIM V. (1938) *Petróleo en América del Sur*. [Petroleum in South America]. (Quito: Boletín de Ministerio de Obras Públicas).
642. OPPENHEIM V. (1939) Sobre el origen de formaciones auríferas del Ecuador. [On the origin of gold-bearing Formations of Ecuador]. *Primer Congr. Nac. Min. Pet., Quito*.
643. OPPENHEIM V. (1940) Las Montañas de Cutucú en Ecuador, S.A. [The mountains of Cutucú in Ecuador, South America]. *Bol. Soc. Geogr. Colomb.*, Vol. 6, No. 5.
644. OPPENHEIM V. (1943) Geología de la Sierra de Cutucú, Frontera Perú-Ecuador. [Geology of the Cutucú Sierra, Perú-Ecuador frontier]. *Bol. Soc. Geol. Perú*, Vols. 14-15, pp. 104-121. [The first geological account of a still little-known area of Ecuador. Many of the stratal names were synonyms of those already in use by the Shell geologists and others].
645. OPPENHEIM V. (1946) Geologic outline of South American oilfields. *Tech. Pap. Pan. Am. Inst., Min. Eng. & Geol., U.S. Sect., U.S.*, No. 4.
646. OPPENHEIM V. (1947) Structural evolution of the South American Andes. *Am. J. Sci.*, Vol. 245, No. 3, pp. 158-174.
647. OPPENHEIM V. (1950) The structure of Ecuador. *Am. J. Sci.*, Vol. 248, No. 8, pp. 527-539.
648. O' ROURKE J.E. (1978) Coal basins of Ecuador. *Spec. Pap., Geol. Soc. Am.*, No. 179, pp. 43-47. [Based on 649 and 904, with no new information. Tertiary fossil identifications erroneous and Tertiary chronology based on these species also wrong].
649. O' ROURKE J.E., SCHNEIDER-SCHERBINA A., MOSQUERA C.F., ALVARADO R. and NUÑEZ DEL ARCO E. (1968) Geology, coal and hydrocarbons of the Cenozoic basins of southern Ecuador. Mineral project. Final report 'Operation 1' (coal and hydrocarbons). Unpublished report of the U.N. Development Programme, Quito. [An important detailed account with maps (1:10000 and 1:50000 of the Cuenca, Loja and Malacatos basins. This report was published as 904 – see also 15, 143, 479, 681 and 849].
650. ORTON J. (1869) Geological notes on the Andes of Ecuador. *Am. J. Sci.*, Ser. 2, Vol. 47, pp. 242-251.

651.ORTON J. (1870a 1st Ed.) *The Andes and the Amazon; or across the continent of South America*. (New York). 2nd Ed. 1871; 3rd Ed. 1876. [Contains probably the first geological observation in the Ecuadorian Oriente (p. 199 refers to what is now known as the Napo Formation)].

652.ORTON J. (1870b) On the evidence of a glacial epoch at the Equator. *Am. Assoc. Adv. Sci.*, Vol. 19, pp. 185-193.

653.OSBORN H. F. (1936) *Proboscidae, Vol. 1: Moeritheroidea, Deinotheroidea, Mastodontoidea*. (New York: American Museum). [See 427 for a synthesis of all the known Ecuadorian Pleistocene mammals].

P

654.PAN AMERICAN UNION (1964) *Survey for the development of the Guayas river basin of Ecuador; an integrated natural resource evaluation*. (Washington, D.C.: Pan American Union, Department of Economic Affairs.)

655.PARODIZ J. J. (1969) The Tertiary non-marine Mollusca of South America. *Ann. Carnegie Mus.*, Vol. 40, pp. 1-242. [An important synthesis and revision of all the South American Tertiary non-marine molluscs].

656.PATTERSON T. C. (1975) Ecuador. P. 16 in *Catalogue of fossil hominids; Part III, Americas, Asia, Australasia*. OAKLEY, K.P., (Editor) (London: British Museum, Natural History).

657.PAULO A. (1974) Wulkan Cotopaxi w świetle badań wyprawy czesko-polskiej. *Wszecławiat*, No. 5 (2127), pp. 113-119.

658.PAULO A., NAREBSKI W., BAKUN-CZUBAROW N., PROCHAZKA K. and WICHROWSKI Z. (1979) Volcanism of Cotopaxi (Ecuador) in the light of study of plagioclases in its lavas. Part 2. Geology, geochemistry and petrogenesis of volcanics of Cotopaxi. (Ecuador). *Pr. Miner. Pol. Akad. Nauk.*, No. 61, 62 pp. [See No. 373 for part I].

659.PAYNE B. R. and SCHROETER P. (1979) Importance of infiltration from the Chimbo River in Ecuador to groundwater. Pp. 145-168 in *Isotope hydrology 1978. Proceedings Series*. International Atomic Energy Agency.

660.PAZ Y MIÑO L. T. (1931a) *La exploración al Reventador*. [The exploration of Reventador]. (Quito: Ministerio de Educación Pública).

661.PAZ Y MIÑO L. T. (1931b) The exploration of El Reventador, Eastern Ecuador. *Geogr. Rev.*, 1931, pp. 669-671.

662.PAZ Y MIÑO L. T. (1944) El Reventador en nueva actividad. [Reventador in new activity]. *Gac. Munic., Quito*, Vol. 108.

663.PEARSALL D. M. (1978) Phytolith analysis of archeological soils; evidence for maize cultivation in formative Ecuador. *Science (Am. Assoc. Adv. Sci.)*, Washington D.C., Vol. 199, No. 4325, pp. 177-178.

664.PEGUM D. M. (1968) Survey of metallic and non-metallic minerals. Termination report, geophysics. *Rep. U.N. Development Programme*, No. DP2. [Unpublished].

665.PEPPER C. M. (1908) Mineral resources of Ecuador. *Min. World. Chicago*, Vol. 28, p. 404.

666.PERSON W. (1977) Earthquakes, October-November 1976. *Earthquakes Inf. Bull.*, Vol. 9, No. 2, pp. 34-36.

667.PETERSEN G. (1949) Condiciones geográficas y geológicas de la Cuenca del Río Zarumilla. [Geographical and geological conditions of the basin of the Zarumilla River]. *Soc. Geol. Perú, Vol. Jubilar*, Fasc. 7, pp. 1-40. [Only indirectly related to Ecuador, as it describes the Peruvian extension of Formations of south-west Ecuador].

668.PHILIP G. (1977) Hydrocarbons in Bolivia, Perú and Ecuador. *Bolsa Rev., London*, Vol. 11, No. 11, pp. 586-592.

669.PICHLER H. (1976) Cenozoic volcanic rocks of Ecuador. [Abstract]. *Resúmenes Congr. Latinoam. Geol.*, No. 9, p. 106.

670.PICHLER H., HOREMANN P.K. and BRAUN A. F. (1976) First petrologic data on lavas of the volcano El Reventador (eastern Ecuador). Vol. 38/39, pp. 129-141.

671.PICHLER H. and ZEIL W. (1972) The Cenozoic rhyolite-andesite association of the Chilean Andes. *Bull. Volcanol.*, Vol. 35, p. 424. [Strontium isotope data (the first) from Cotopaxi].

672.PICHLER H., STIBANE F. R. and WEYL R. (1974) Basischer Magmatismus und Krustenbau im Südlichen Mittelamerika, Kolumbien und Ecuador. [Basic magmatism and crust formation in southern Central America, Colombia and Ecuador]. *Neus Jahrb. Geol. Paläontol. Montash.*, No.2, pp. 102-106.

673.PIEDRA C.T. (1947) *La minería y el petróleo en el Ecuador, enero 1946-marzo 1947*. [Mining and petroleum in Ecuador, January 1946-March 1947]. (Quito: Dirección General de Minería y Petróleo).

674.PILSBRY H. A. (1944) Molluscan fossils from the Río Pachitea and vicinity in eastern Perú. *Proc. Acad. Nat. Sci. Philadelphia*, Vol. 96, pp. 137-153. [Refers to the Cuenca molluscs described in 510 and 543].

675.PILSBRY H. A. and OLSSON A. A. (1941) A Pliocene fauna from western Ecuador. *Proc. Acad. Nat. Sci. Philadelphia*, Vol. 93, pp. 1-79. [The first, and important, detailed descriptions of the faunas of the Pliocene deposits of coastal Ecuador].

676.PILSBRY H. A. and OLSSON A. A. (1951) Tertiary and Cretaceous Cirripedia from north-western South America. *Proc. Acad. Nat. Sci. Philadelphia*, Vol. 103, pp. 197-210. [Some Tertiary species named in 640, described here].

677.POEY A. (1868) Relación del gran terremoto acaecido el 13 y 16 de agosto de 1868 en las Repúblicas de Perú, Chile y del Ecuador. [Account of the great earthquake which occurred on 13th and 16th of August 1868 in the Republics of Perú, Chile and Ecuador]. *An. R. Acad. Cienc. Med. Fis. Nat., Habana*, Vol. 5, pp. 245-260, 365-374.

678.PROAÑO J. F. (1894) Mastodonte del Chimborazo. *Mem. Liceo Chimborazo, Riobamba*.

679.PUTTE H. W. v. DE. (1942) Latin America – mining frontier: Ecuador. *Eng. Min. J.*, Vol. 143, No. 8, pp. 106-108. [Interesting resumé of the known occurrences of mineralisation]

680.PUTZER H. (1968) Tertiäre Lignite im interandinen Graben von Ecuador als Beispiel für syn-orogene Kohlebildung in intramontanen Becken. [Tertiary lignites in the Interandean graben of Ecuador as an example of synorogenic coal Formation in intermontane basins]. *Geol. Jahrb.*, Vol. 85, pp. 461-488.

681.PUTZER H. and SCHNEIDER-SCHERBINA A. (1958) Lagerstätten Untersuchungen in Ecuador. [Investigation of deposits in Ecuador]. Unpublished report of the Misión Alemana de Cooperación Técnica Minera; Dirección General de Geología y Minas, Quito.

R

682.RAFF A. D. (1968) Sea-floor spreading – another rift. *J. Geophys. Res.*, Vol. 73, No. 12, pp. 2699-2705.

683.RAMÍREZ J.E. (1950) El gran terremoto ecuatoriano de Pelileo, agosto 5, 1949. [The great Ecuadorian earthquake of Pelileo, August 5th, 1949]. *Rev. Acad. Colomb. Cienc.*, Vol. 8, No. 29, pp. 129-139.

684. RAMÍREZ J.E. (1958) Los terremotos de enero y febrero de 1958 en la costa del Pacífico del Ecuador y Colombia. [The great earthquakes of January and February 1958 in the Pacific coast of Ecuador and Colombia]. *Publ. Inst. Geofís. Andes. Colomb., Sudam.*, No. 14.
685. RAMÍREZ J. E. and ALDRICH L. T. (1977) Historia de un estudio geofísico en mar y tierra en el Sur de Colombia y en el Ecuador. [History of a geophysical study in the sea and on land in southern Colombia and Ecuador]. Pp. 17-23 in *Nariño; Proyecto cooperativo internacional 1973; la transición océano-continente en el suroeste de Colombia*. RAMÍREZ J.E. and ALDRICH L.T. (Editors) (Bogotá: Instituto Geofísico, Universidad Javeriana).
686. RATH G. VOM (1873) Einige Gesteine aus dem Hochlande von Quito (Ecuador). [Rock types from the highlands of Quito (Ecuador)]. *Verh. Naturhist. Ver. Preuss. Rheinlande*, Vol. 30, pp. 229-234.
687. RATH G. VOM (1875) Beiträge zur Petrographie. I. Über einige Andesgesteine. [Contributions to petrography. I. Concerning some kinds of rocks in the Andes]. *Z. Dtsch. Geol. Ges.*, Vol. 27, pp. 295-343.
688. REA D. K. (1976) Analysis of a fast-spreading rise crest: the east Pacific rise, 9° to 12° south. *Marine Geophys. Res.*, Vol. 2, pp. 291-343.
689. REA D. K. and MALFAIT B. T. (1974) Geologic evolution of the northern Nazca Plate. *Geology*, Vol. 2, No. 7, pp. 317-320.
690. REDWOOD B. (1896) *Treatise on petroleum*. (London). [Ecuador, p. 103].
691. REESIDE J. B. Jr (1937) Informe sobre los fósiles colectados al Este de los Andes del Ecuador. Pp. 65-68 in *Exploraciones geológicas de Wasson y Sinclair*. [Report about the fossils collected in the east of the Andes of Ecuador. Pp. 65-68 in Geological explorations of Wasson and Sinclair]. *Bol. Mens. Minist. Obras Publ., Quito*, Vol. 2, Nos. 18-20. [A translation of the palaeontological part of 938]
692. REISS W. (1872) Mitteilungen des Herrn Reiss über eine Reise in Südamerika aus Briefen an die Herren G. Rose und Roth vom Dezember 1871. [Information from Herr Reiss concerning a journey in South America from letters to Messrs. G. Rose and Roth in December 1871]. *Z. Dtsch. Geol. Ges.*, Vol. 24, pp. 377-384.
693. REISS W. (1873a) Carta del Dr. Reiss a S.E. el Presidente de la República sobre su ascensión al Cotopaxi, Quito, 1873. [Letter from Dr. Reiss to His Excellency, the President of the Republic, about his ascent of Cotopaxi, Quito]. German translation by RATH, VOM G. *Verh. Naturhist. Ver. Preuss. Rheinland*, 1873, Vol. 30, pp. 108-116.
694. REISS W. (1873b) Über eine Reise nach den Gebirgen des Illiniza und Corazón und im Besonderen über eine Besteigung des Cotopaxi. [Concerning a journey to the mountains of Illiniza, Corazón, and in particular an ascent of Cotopaxi]. *Z. Dtsch. Geol. Ges.*, Vol. 25, pp. 71-95.
695. REISS W. (1873c) *Carta del Dr. Reiss a S.E. el Presidente de la República sobre sus viajes a las montañas del Sur de la Capital, Quito*. [Letter from Dr. Reiss to His Excellency, the President of the Republic, concerning his travels to the mountains south of the Capital]. (Quito: Impresor Nacional). [Translated into German in 1875 – see 698].
696. REISS W. (1874a) Besuch des Sangay, Tungurahua und Pelileo. [A visit to Sangay, Tungurahua and Pelileo]. *Z. Dtsch. Geol. Ges.*, Vol. 26, pp. 605-609.
697. REISS W. (1874b) Über Lavenströme am Cotopaxi und Tungurahua. [Concerning lava flows on Cotopaxi and Tungurahua]. *Z. Dtsch. Geol. Ges.*, Vol. 26, pp. 907-927.
698. REISS W. (1875) Bericht über eine Reise nach dem Quilotoa und dem Cerro Hermoso in den ecuadorianischen Cordilleren. [Report of a journey to Quilotoa and Cerro Hermoso in the Cordilleras of Ecuador]. *Z. Dtsch. Geol. Ges.*, Vol. 27, pp. 274-294. [German translation of 695 by G. vom Rath].
699. REISS W. (1880) Über seine Reisen in Südamerika. [Concerning his travels in South America]. *Verh. Ges. Erdkd. Berlin*, Vol. 4, pp. 122-136.
700. REISS W. (1883) Sinken die Anden? [Are the Andes sinking?]. *Verh. Ges. Erdkd. Berlin*, Vol. 7, pp. 45-56.
701. REISS W. (1872) Über eine fossile Säugetier-Fauna von Punín bei Riobamba in Ecuador. I. Die geologische Verhältnisse der Fundsteller fossiler Säugethier-Knochen in Ecuador. [Concerning a fossil mammalian fauna at Punín near Riobamba in Ecuador. I. The geology of the sites of discovery of fossil mammalian bones in Ecuador]. *Palaeontol. Abh.*, Vol. 1, No. 2, pp. 41-56. Separate, pp. 3-18, (Berlin: Reimer). Spanish translation by GOLDBAUM W. *An. Univ. Cent. Ecuador*, 1938, Vol. 60, No. 304, pp. 925-958.
702. REISS W. (1901-1904) *Ecuador 1870-1874. Petrographische Untersuchungen*. [Ecuador 1870-1874. Petrographical research]. (Berlin: Asher). [I: *Die Vulkanischen Gebirge der Ost-Cordillere von Pamba-Marca bis zum Antisana*] [The volcanic mountains of the eastern Cordillera from Pamba-Marca to Antisana]. By W. Reiss, 1901, pp. 3-56 and E. Elich, 1901, pp. 47-113. II: *Die jüngeren Gesteine der ecuadorianischen Ost-Cordillere ...* [The younger rocks of the eastern Cordillera in Ecuador], by F. Tannhäuser, 1904, pp. 115-186. III: *Die älteren Gesteine der ecuadorianischen Ost-Cordillere*. [The older rocks of the eastern Cordillera], by F. von Wolff, 1904, pp. 187-304.
703. REISS W. (1921) Reisebriefe aus Südamerika 1868-1876, aus dem Nachlasse herausgegeben und bearbeitet von K.H. Dietzel, Leipzig. [Travel letters from South America 1868-1876, posthumous works published and revised by K.H. Dietzel, Leipzig]. *Wiss. Veröff. Ges. Erdkd.*, Vol. 9; (München: Duncker and Humblot). Spanish translation by MARTÍNEZ A. *An. Univ. Cent. Ecuador*, 1929, Vol. 43, No. 270, pp. 491-554.
704. REISS W. and STÜBEL A. (1892-1898) *Reisen in Südamerika. Das Hochgebirge der Republik Ecuador. Petrographische Untersuchungen. I. West-Cordillere*. [Travels in South America. The high mountains of the Republic of Ecuador. Petrographical research. I: Western Cordillera] (Berlin: Asher). [Foreword by W. Reiss, 1898. 1. *Tulcán bis Escaleras-Berge*] [Tulcán to the Escaleras mountains], by M. Belowsky, 1892, pp. 1-68. 2. *Pululagua bis Guagua-Pichincha* [Pululagua to Guagua-Pichincha], by R. Herz, 1892, pp. 71-140. 3. *Atacazo bis Illiniza* [Atacazo to Illiniza], by E. Elich, 1893, pp. 143-177. 4. *Río Hatuncama bis Cordillera de Llangagua* [Río Hatuncama to Cordillera de Llangagua], by A. Klautzsch, 1893, pp. 181-223. 5. *Von den Ambato-Bergen bis zum Azuay* [From the Ambato mountains to Azuay], by A. Klautzsch, 1898, pp. 227-294. *Namen- und Sach-Verzeichniss*, 1898. [Name and subject indices], pp. 295-358.
705. REISS W. and STÜBEL A. (1896-1902) *Reisen in Südamerika. Das Hochgebirge der Republik Ecuador. Petrographische Untersuchungen. II: Ost-Cordillere*. [Travels in South America. The high mountains of the Republic of Ecuador. Petrographical Research. II: Eastern Cordillera]. (Berlin: Asher). [Foreword by W. Reiss, 1902. 1. *Die Berge des Ibarra-Beckens und der Cayambe*] [The mountains of the Ibarra basin and Cayambe], by E. Esch, 1896, pp. 3-60. 2. *Der Cotopaxi und die umgebenden Vulkanberge: Pasochoa, Rumiñahui, Sincholagua und Quilotoa*. [Cotopaxi and the surrounding volcanic mountains: Pasochoa, Rumiñahui, Sincholagua and Quilotoa], by W. Reiss, 1902, pp. 63-183 and A. Young, 1902, pp. 191-275. *Übersichten Namen und Sach-Verzeichnisse*. [Summaries, name and subject indices], 1902, pp. 277-356.

- 706.**REPETTO F. (1977) Un mamífero fósil nuevo en el Terciario del Ecuador. (Azuay-Cañar). [A new mammalian fossil in the Tertiary of Ecuador (Azuay-Cañar)]. *Tecnológica, Esc. Polit. Litoral, Guayaquil*, Vol. 1, No.2, pp. 33-38.
- 707.**RIBADENEIRA Ch J. A. (1942) La minería y el petróleo en el Ecuador. Anuario 1942. [Mining and petroleum in Ecuador. Yearbook 1942] (Quito). [Some of the stratal names introduced by the oil companies first published here]
- 708.**RIBADENEIRA Ch J. A. (1943) The 'Shucos' sulphur deposit. *Univ. Cent. Ecuador, Inst. Bot.*, Vol. 2, pp. 57-73; [Abstract]. *Chem. Abstr.*, 1944, Vol.38, No. 10, p. 2292.
- 709.**RIBADENEIRA Ch J. A. (1955) Informe sobre el estudio geológico de los movimientos del suelo al pie de la ciudad de Guaranda. [Report on the geological study of ground movement at the foot of the city of Guaranda]. *Bol. Inst. Cienc. Nat. Univ. Cent. Ecuador*, Vol. 1, No. 2, pp. 130-134.
- 710.**RICHARDS A. F. (1954) Volcanic eruptions of 1953 and 1948 on Isabela Island, Galápagos Islands, Ecuador. *Volcano Lett. Hawaii. Volcanic. Res. Assoc.*, Vol. 525, pp. 1-3.
- 711.**RICHARDS A. F. (1957) Volcanism in eastern Pacific Ocean basin: 1945-1955. *Congr. Geol. Inst.*, Sect. 1, Vulcanología del Cenozoico, pp. 19-31.
- 712.**RICHARDS A. F. (1962) *Catalogue of the active volcanoes of the world. XIV. Archipelago [sic] de Colón, Isla San Félix and Islas Juan Fernández.* (Rome: International Volcanic Association).
- 713.**RICHARDS A. Z. (1960) Report on production possibilities of high-quality solar salt in Ecuador. United States of America Operations mission to Ecuador. International Cooperation Administration.
- 714.**RICHARDSON C. (1933) Petrology of the Galápagos Islands. *Bull. Bernice P. Bishop Mus.*, Vol. 110, pp. 45-67.
- 715.**RIGHI R. M. DE. and BLOOMER G. (1975) Oil and gas developments in the Upper Amazon Basin; Colombia, Ecuador and Perú. *Proc. World Pet. Congr.* No. 9, Vol. 3, pp. 181-192.
- 716.**RIMBACH C. (1931) Contribución a la historia geológica de la Cordillera Ecuatoriana. [Contribution to the geological history of the Ecuadorian Cordillera]. *Bol. Acad. Nac. Hist. Quito*, Vol. 2, No. 30-32.
- 717.**ROBALINO F. (1977) *Espesor de la corteza en Quito mediante el análisis del espectro de las ondas longitudinales de periodo largo.* [Thickness of the crust in Quito by means of analysis of the spectrum of longitudinal waves of long period] (Quito: Instituto Panamericano de Geografía e Historia, XI Asamblea General, Sección Nacional del Ecuador).
- 718.**ROBERTS T. R. (1975) Characoid fish teeth from Miocene deposits in the Cuenca Basin, Ecuador. *J. Zool. London*, Vol. 175, pp. 259-271. [The first detailed description of fossil teeth of this group from Ecuador].
- 719.**ROSENBUSCH H. (1872) Petrographische Studien an den Gesteinen des Kaiserstuhls. [Petrographical studies of the rocks of the Kaiserstuhls]. *Neues. Jahrb. Mineral. Geol. Paläontol.*, 1872, Vol. 40, pp. 155-170.
- 720.**ROTH J. (1874) Über die Obsidian-und Perlitströme des Guamaní in Ecuador. [Concerning obsidian and perlite flows on Guamaní in Ecuador]. *Monatsber. K. Preuss. Akad. Wiss. Berlin*, Vol. 39, pp. 378-385.
- 721.**RUEGG W. (1968) Geological features and oil possibilities of western Ecuador. *22nd Int. Geol. Congr., India*, Pt. 1, Proc., Sect 1, pp. 103-125.
- 722.**RUESS G. L. and GROSSMAN J. (1951) Informe preliminar sobre los carbones de Azogues-Biblián. [Preliminary report on the coal of Azogues-Biblián]. *Bol. Inf. Cient. Nac. Quito*, Vol. 3, Nos. 36-37, pp. 485-495. [See also 49, 110, 590, 591, 648, 681, 804, 904].
- 723.**RYDER R. H. (1972) Characterization of the soils of Andean Ecuador; the case of the Pisque Valley. Pp. 318-319 in *International Geography, 1972. La Geographie Internationale. Pap. Int. Geogr. Congr. Congr. Geogr. Commun.*, No. 22, Vol. 1.
- 724.**RYAN D. J. (1978) Volcanogenic sedimentation on Andean Plateau, northern Ecuador. [Abstract]. *Bull. Am. Assoc. Pet. Geol.*, Vol. 62, No. 3, pp. 559-560.

S

- 725.**SAABYE O. A. F. (1894) Gold mining in Ecuador. *Eng. Min. J.*, Vol. 58, p. 417.
- 726.**SAIGUSA M. (1975) Relation between copper content in soils and copper grade of some porphyry copper deposits in humid tropical regions. *Dev. Econ. Geol.*, No. 1. (Geochemical exploration 1974), pp. 511-522.
- 727.**SALAZAR E. (1975) La geología del flanco septentrional del Volcán Tungurahua. [The geology of the northern flank of Tungurahua volcano]. Unpublished thesis, Escuela Politécnica Nacional, Quito.
- 728.**SALAZAR S. P. B. (1959) *Esqueleto tectónico Ecuatoriano.* [Ecuadorian tectonic framework]. (Quito: Observatorio Astronómico, Ministerio de Educación Nacional).
- 729.**SANTO T. (1969) A short study on the earthquake swarm in Galápagos Islands region in June 1958. *Bull. Int. Inst. Seismol. Earthquake Eng.*, Vol. 6, pp. 39-43.
- 730.**SAPPER C. (1928) Las erupciones volcánicas. [The volcanic eruptions]. *An. Univ. Cent. Ecuador*, Vol. 40, pp. 105-113.
- 731.**SAPPER K. (1917) *Katalog der geschichtlichen Vulkanausbrüche.* [Catalogue of historical volcanic eruptions]. (Strasbourg).
- 732.**SAPPER K. (1927) *Vulkankunde [Study of volcanoes].* (Stuttgart)
- 733.**SARMA A. (1977) Approaches to paleo-ecology. In *Elements of anthropology; a series of introductions.* (Iowa: William Brown Co. Publishers).
- 734.**SARMA A. V. N. (1973) Evidence of post-Pliocene desiccation in southwest Ecuador. *Geol. Mijnbouw*, Vol. 52, No. 1, pp. 33-34. [Useful documentation of one Holocene change in climate that has occurred in coastal Ecuador].
- 735.**SARMA A. V. N. (1974) Holocene paleoecology of south coastal Ecuador. *Proc. Am. Philos. Soc.*, Vol. 118, No. 1, pp. 93-134. [An expansion of 734].
- 736.**SARMIENTO A. (1958) *Monografía científica del Oriente Ecuatoriano.* [Scientific monograph of the Ecuadorian Oriente]. (Quito).
- 737.**SAUER W. (1938a) Informe sobre los estudios geológicos en las provincias australes del Ecuador. [Report on the geological studies in the southern provinces of Ecuador]. *An. Univ. Cent. Ecuador*, Vol. 61, No. 305, pp. 861-865.
- 738.**SAUER W. (1938b) *Observaciones en la región del terremoto del Valle de los Chillos (9 agosto de 1938).* [Observations in the earthquake region of the Chillos Valley (9 August 1938)]. (Quito: Observatorio Astronómico y Meteorológico).
- 739.**SAUER W. (1943) Memoria explicativa del mapa geológico de Quito. *An. Univ. Cent. Ecuador*, Vol. 71, Nos. 319-320, pp. 5-34; Separate, 1943. [A speculative account of a very poor map (see 752)]
- 740.**SAUER W. (1945) *Informe sobre los yacimientos de caliza, toba calcárea, carbón, arcilla y yeso de las provincias de Cañar y Azuay.* [Report on the deposits of limestone, calcareous tufa, coal, clay and gypsum of the provinces of Cañar and Azuay]. (Quito: Caja de Pensiones).

- 741.SAUER W. (1949) Contribuciones para el conocimiento del Cuaternario en el Ecuador. [Contributions for the knowledge of the Quaternary in Ecuador]. *An. Univ. Cent. Ecuador*, Vol. 77, No. 328, pp. 326-364; Separate, 1950.
- 742.SAUER W. (1950) Mapa geológico del Ecuador 1/1500000; [in black and white]. (Quito: Universidad Central and Dirección de Minería); [in colour]. (Zürich: Orell Füssli).
- 743.SAUER W. (1955a) *Coprinisphaera Ecuadoriensis*, un fósil singular del Pleistoceno. [*Coprinisphaera ecuadoriensis*, a unique fossil of the Pleistocene]. *Bol. Inst. Cienc. Nat. Univ. Cent. Ecuador*, Vol. 1, No. 2, pp. 123-129; Separate, 1955. [See also 745].
- 744.SAUER W. (1955b) Los terremotos de la Provincia de Imbabura acaecidos el 11 de mayo y el 24 de julio de 1955. [The earthquakes of the Province of Imbabura which occurred on the 11th of May and the 24th of July 1955]. *Bol. Inf. Cient. Nac. Quito*, Vol. 8, No. 71 pp. 159-169.
- 745.SAUER W. (1956) *Coprinisphaera Ecuadoriensis* (Bola de Cangagua) y las esferas elaboradas actualmente por escarabajos de las Scarabaeidae. [*Coprinisphaera ecuadoriensis* (Ball of Cangagua) and the present-day spheres made by the beetle of the Scarabaeidae]. *Bol. Inf. Cient. Nac. Quito*, Vol. 8, No. 75 pp. 550-555. [See also 743].
- 746.SAUER W. (1957) *El mapa geológico del Ecuador. Memoria explicativa*. [The geological map of Ecuador. Explanatory report]. (Quito: Universidad Central).
- 747.SAUER W. (1958) El Cerro Hermoso de los Llanganates en el Ecuador. [Cerro Hermoso of the Llanganates in Ecuador]. *Bol. Inf. Cient. Nac. Quito*, Vol. 9, No. 85 pp. 465-499.
- 748.SAUER W. (1959a) Merkwürdige Kugeln in Tuffen Ecuadors und ihre Deutung. [Remarkable spherical structures in tuffs of Ecuador and their interpretation]. *Nat. Vol.*, Vol. 89, pp. 118-124.
- 749.SAUER W. (1959b) Auf den Spuren Alexander von Humboldt's am Chimborazo. [In the tracks of Alexander von Humboldt on Chimborazo]. *Nat. Volk*, Vol. 89, pp. 161-169.
- 750.SAUER W. (1960) Alejandro de Humboldt en el Ecuador. *Bol. Inf. Cient. Nac. Quito*, Vol. 10, No. 90, pp. 274-291.
- 751.SAUER W. (1965) *Geología del Ecuador*. (Quito). [The first book devoted wholly to the geology of Ecuador. Partially revised and published in German in 1953].
- 752.SAUER W. and ESTRADA A. (1940) *Levantamiento geológico de la región de Quito. Hoja 40 del mapa topográfico del Ecuador*. [Geological mapping of the region of Quito. Sheet 40 of the topographical map of Ecuador]. (Quito: Servicio de Geografía Militar).
- 753.SAUER W. and PUTZER H. (1971) *Geologie von Ecuador*. (Berlin: G. Borntraeger). [A partially revised, illustrated version, in German, of 677; the coastal section makes no reference to 209].
- 754.SAVOYAT E. and SANTILLÁN G. (1972) *Estudio Geológico petrolero de la cuenca del Oriente ecuatoriano*. [Geological and petroleum study of the basin of the Ecuadorian Oriente]. (Quito: Instituto Francés del Petróleo; Dirección General de Hidrocarburos). [See also 292 and 295].
- 755.SAVOYAT E., VERNET R., SIGAL J., MOSQUERA C., GRANJA J., and GUEVARA G. (1970a) *Formaciones sedimentarias de la Sierra tectónica andina en el Ecuador*. [Sedimentary Formations of the tectonic Andean Sierra of Ecuador]. (Quito: Instituto Francés del Petróleo; Servicio Nacional de Geología y Minería). [A very important publication, with maps, of the Cretaceous and Tertiary sediments and microfauna (not figured), but unfortunately of limited distribution. Incorporated in 295].
- 756.SAVOYAT E., VERNET R., SIGAL J., MOSQUERA C., GRANJA J., and GUEVARA G. (1970b) *Estudio general de la Cuenca de Esmeraldas. Estudio micropaleontológico parcial de las Formaciones de la Sierra*. [General study of the Esmeraldas Basin. Partial Micropaleontological study of the Formations of the Sierra]. (Quito: Instituto Francés del Petróleo; Servicio Nacional de Geología y Minería). [See remarks for 755].
- 757.SCHEEPMACKER A. C. and EGRED J. (1966) Catálogo de terremotos 1958-1965. [Catalogue of earthquakes 1958-1965]. *Bol. Sismol. Obs. Astron. Quito*, Ser. A., No. 1.
- 758.SCHILLING J. G., ANDERSON R. N. and VOGT P. (1976) Rare earth, Fe and Ti variations along the Galápagos spreading centre and their relationship in the Galápagos mantle plume. *Nature, London*, Vol. 261, p. 108.
- 759.SCHOFIELD E. K. and COLINVAUX P. A. (1969) Fossil *Azolla* from the Galápagos Islands. *Bull. Torrey. Bot. Club*, Vol. 96, pp. 623-628.
- 760.SCHMIDT V. (1967) Caves in Ecuador. *Natl. Speleol. Soc. Am. News*, Vol. 25, No. 12, p. 209.
- 761.SCHULMAN N., FLEXER A. and WAKSHAL E. (1965) Geology and groundwater possibilities of central Manabí, Ecuador. Ministry of Foreign Affairs, Department of International Cooperation, Israel. [A useful report, but several stratal names of dubious value introduced].
- 762.SCHUMWAY G. and CHASE T. E. (1961) Bathymetry in the Galápagos region. *Occas. Pap. California Acad. Nat. Sci.*, No. 44, pp. 11-19.
- 763.SCHWADE I. T. (1962) Petroleum geology of coastal Perú and Ecuador. [Abstract]. *Bull. Am. Assoc. Pet. Geol.*, Vol. 46, No. 2, p. 279.
- 764.SCHWEINFURTH S. P. (1959) Geology of the Estancia Hills area, Guayas Province, Ecuador. Unpublished geological report of the California Ecuador Petroleum Co. [A useful report, but needs now to be read in the light of 209].
- 765.SCLATER J. G. and KLITGORD K. D. (1973) A detailed heat flow, topographic, and magnetic survey across the Galápagos spreading centre at 86° W. *J. Geophys. Res.*, Vol. 78, pp. 6951-6975.
- 766.SCLATER J. G., VON HERZEN R. P., WILLIAMS D. L., ANDERSON R. N. and KLITGORD K. D. (1974) Galápagos spreading centre: heat-flow low on the north flank. *Geophys. J.R. Astron. Soc.*, Vol. 36, pp. 609-626.
- 767.SEGOVIA A. and EGRED J. (1976) Actividades sobre ingeniería de sismo-resistencia en el Ecuador. [Earthquake-resistant engineering in Ecuador]. *Rev. Geofis.*, No. 5, pp. 203-206.
- 768.SEMANATE A. D. (1944) Notas geológicas de Baños y sus alrededores. [Geological notes of Baños and its environs]. *Flora. Quito*, Vol. 5, Nos. 13-14, pp. 9-37.
- 769.SEMANATE A. D. (1951) Baños y sus alrededores. Historia geológica del Tungurahua y del Pastaza. [Baños and its environs. Geological history of Tungurahua and of the Pastaza]. *Bol. Inf. Cient. Nac. Quito*, Vol. 4, No. 41, pp. 141-153.
- 770.SEMANATE A. D. (1952) Geología de la Hoya de Yambo. [Geology of the Basin of Yambo]. *Bol. Inf. Cient. Nac. Quito*, Vol. 5, No. 51, pp. 405-413.
- 771.SEMANATE A. D. (1954) *Las rocas del metamorfismo o esquistos cristalinos de la Cordillera Oriental de la orilla izquierda del Pastaza*. [The metamorphic rocks or crystalline schists of the Eastern Cordillera of the left bank of the Pastaza]. In *Los surcos de la Ciencia*. (Quito: Casa de la Cultura Ecuatoriana).
- 772.SENN A. (1940) Paleogene of Barbados and its bearing on history and structure of Antillean-Caribbean region. *Bull. Am. Assoc. Pet. Geol.*, Vol. 24, No. 9, pp. 1548-1610.
- 773.SERRANO C. M. (1959) *Mapa sísmico y tectónico del Ecuador*. [Seismic and tectonic map of Ecuador]. (Quito: Observatorio Astronómico, Ministerio de Educación Pública).
- 774.SHEPPARD G. (1925) The occurrence of boulders in the Tertiary Formations of Ecuador, South America. *Geol. Mag.*, Vol. 62, pp. 368-369.
- 775.SHEPPARD G. (1926a) The geology of the Colonche District of Ecuador, which includes the northern property of the Anglo Ecuadorian Oilfields Ltd. *Geol. Rep. Anglo Ecuadorian Oilfields Ltd.*, No. 15 [Unpublished]. [The term 'Guayaquil Limestone' (equivalent to the San Eduardo Limestone) introduced and erroneously thought to be of Cretaceous age].

- 776.SHEPPARD G. (1926b) Relation of volcanic dykes to oil-bearing formations of southern Ecuador, South America. *Econ. Geol.*, Vol. 21, No. 1 pp. 70-80. [See also 780, 784].
- 777.SHEPPARD G. (1927a) Geological observations on Isla de la Plata, Ecuador, South America. *Am. J. Sci.*, Ser. 5, Vol. 13, No. 78, pp. 480-486.
- 778.SHEPPARD G. (1927b) Further observations on the Clay Pebble Bed of Ancon (Ecuador). *Geol. Mag.*, Vol. 64, No. 755, pp. 227-236.
- 779.SHEPPARD G. (1927c) The occurrence of gypsum in the Tertiary clays and sandstones of Ecuador. *Geol. Mag.*, Vol. 64, No. 757, pp. 298-308.
- 780.SHEPPARD G. (1927d) Observations on the geology of the Santa Elena Peninsula, Ecuador, South America. *J. Inst. Pet. Technol.*, Vol. 13, pp. 424-461. [The first publication of the name *Seca shales*, which was introduced in unpublished 558 – needs to be read in the light of 209].
- 781.SHEPPARD G. (1928a) Notes on the Miocene of Ecuador. *Bull. Am. Assoc. Pet. Geol.*, Vol. 12, No. 6, pp. 671-673. [One of the first references to the Miocene of Ecuador].
- 782.SHEPPARD G. (1928b) The geology of Ancón Point, Ecuador, S.A. *J. Geol.*, Vol. 36, No. 2, pp. 113-138. [A detailed description of the Ancón Point 'Stage' – needs to be read in the light of 209]
- 783.SHEPPARD G. (1928c) The Tertiary sandstones of Ecuador. *Panam. Geol.*, Vol. 49, pp. 271-274.
- 784.SHEPPARD G. (1928d) Chert deposits in Ecuador, South America. *Geol. Mag.*, Vol. 65, pp. 343-353. [See also 776, 780].
- 785.SHEPPARD G. (1928e) Notas geológicas sobre el derrumbe cerca de Huigra en 1925. [Geological notes on the landslide near Huigra in 1925]. *An. Univ. Cent. Ecuador*, Vol. 41, No. 266, pp. 211-222.
- 786.SHEPPARD G. (1929a) The age of the Guayaquil Limestone. *Bull. Am. Assoc. Pet. Geol.*, Vol. 13, No. 4, pp. 383-384. [An account in which the Upper Cretaceous Guayaquil Chert are confused with the Middle Eocene San Eduardo Limestone – see also 805].
- 787.SHEPPARD G. (1929b) Marine denudation in Ecuador. *Panam. Geol.*, Vol. 52, pp. 115-117.
- 788.SHEPPARD G. (1930a) The igneous rocks of southwestern Ecuador. *J. Geol.*, Vol. 38, No. 4, pp. 318-334.
- 789.SHEPPARD G. (1930b) Igneous and associated rocks from the Andes of eastern Ecuador. *Geol. Mag.*, Vol. 67, No. 794, pp. 361-371.
- 790.SHEPPARD G. (1930c) Geology of southwest Ecuador. *Bull. Am. Assoc. Pet. Geol.*, Vol. 14, No. 3, pp. 263-309.
- 791.SHEPPARD G. (1930d) Estudios petrográficos de las rocas ígneas encontradas en las provincias de Manabí y del Guayas. [Petrographical studies of the igneous rocks found in the provinces of Manabí and Guayas]. *An. Univ. Cent. Ecuador*, Vol. 45, No. 273, pp. 51-76.
- 792.SHEPPARD G. (1931a) Bibliografía de la geología del Ecuador. [Bibliography of the geology of Ecuador]. *An. Univ. Cent. Ecuador*, Vol. 46, No. 276, pp. 285-298.
- 793.SHEPPARD G. (1931b) Western Andes and their relation to the Tertiary coastal belt, Ecuador. *Geol. Mag.*, Vol. 68, No. 809, pp. 481-495.
- 794.SHEPPARD G. (1932a) Calcareous 'pipes' in the Quaternary of Ecuador. *Am. J. Sci.*, Vol. 23, pp. 497-500.
- 795.SHEPPARD G. (1932b) Lavas of Ecuadorian Cordillera. *Panam. Geol.*, Vol. 58, pp. 7-22.
- 796.SHEPPARD G. (1932c) The salt industry in Ecuador. *Geogr. Rev.*, Vol. 22, pp. 403-410.
- 797.SHEPPARD G. (1933a) Outlines of Ecuadorian geology. *Panam. Geol.*, Vol. 59, pp. 45-56, 115-126.
- 798.SHEPPARD G. (1933b) Beekite in Tertiary oil-bearing Formations of southern Ecuador. *Bull. Am. Assoc. Pet. Geol.*, Vol. 17, p. 1388.
- 799.SHEPPARD G. (1933c) La ocurrencia de 'beekite' en las Arcillas Terciarias del Ecuador. [The occurrence of beekite in the Tertiary clays of Ecuador.] *An. Univ. Cent. Ecuador*, Vol. 51, No. 285, pp. 157-160.
- 800.SHEPPARD G. (1934a) Clay Pebble Bed of Ancón, Ecuador. *Panam. Geol.*, Vol. 61, No. 2, pp. 97-102. [Needs to be read in the light of 209 – see also 90, 154, 155, 178, 535, 536, 774, 778, 806].
- 801.SHEPPARD G. (1934b) Geology of the interandine basin of Cuenca, Ecuador. *Geol. Mag.*, Vol. 71, No. 842, pp. 356-370. Spanish translation by SALAZAR ORREGO V. *Rev. Univ. Cuenca*, 1935, No. 15, pp. 49-72. Spanish translation by SHEPPARD G. *An. Univ. Cent. Ecuador*, 1938, Vol. 60, No. 304, pp. 493-510. [The first attempt at a detailed stratigraphy of the Cuenca Basin (fossils described earlier in 543) – see also 510. Stratigraphy revised in 283, 648 and 143].
- 802.SHEPPARD G. (1935) Petroleum situation in Ecuador and prospects. *Pet. Times*, Vol. 34, pp. 223-224; *Rev. J., inst. Pet. Technol.*, Vol. 21, p. 144.
- 803.SHEPPARD G. (1937) *The geology of south-western Ecuador*. (London: Murby). [A well-produced synthesis, now largely out of date (see 209), of much of the author's previous publications, but it does contain some new information].
- 804.SHEPPARD G. (1938) Informe sobre la existencia de depósitos de carbón de piedra en Biblián. [Report on the existence of deposits of coal at Biblián]. *Bol. Mens. Minist. Obras. Publ. Quito*, Vol. 3, Nos. 23-25, pp. 71-73.
- 805.SHEPPARD G. (1946) The geology of the Guayaquil estuary, Ecuador. *J. Inst. Pet.*, Vol. 32, No. 272, pp. 492-514. Spanish translation. *Bol. Mens. Minist. Obras. Publ. Quito*, 1948, Nos. 63-65, pp. 9-25. [The confusion of 786 is still perpetuated here, but the name San Eduardo Limestone was accepted in place of Guayaquil Limestone].
- 806.SHEPPARD G. and BUSHNELL G. H. S. (1932) The Clay Pebble Bed of Ancón, Ecuador. *Geol. Mag.*, Vol. 69, pp. 284-286; *J. Inst. Pet. Technol.*, Vol. 19, No. 122, pp. 1037-1038. [Needs to be read in the light of 209 – see also 90, 154, 155, 178, 535, 536, 774, 778, 800].
- 807.SHEPPARD G. and BUSHNELL G. H. S. (1933) Metamorphic rocks of the eastern Andes near Cuenca, Ecuador. *Geol. Mag.*, Vol. 70, pp. 321-330. [The first account of the metamorphic rocks of this area].
- 808.SHUMWAY G. A. (1953) Galápagos islands regional bathymetric trends [Abstract]. *Bull. Geol. Soc. Am.*, Vol. 64, No. 12, Pt 2, pp. 1514-1515.
- 809.SHUMWAY G. A. (1954) Carnegie Ridge and Cocos Ridge in the east equatorial Pacific. *J. Geol.*, Vol. 62, No. 6, pp. 573-586.
- 810.SIEMIRADZKI J. (1885) Hypersthen-andesit aus W. Ecuador. [Hypersthen-andesite from western Ecuador]. *Neues Jahrb. Mineral. Geol. Paläontol.*, Vol. 1, pp. 115-158.
- 811.SIEMIRADZKI J. (1886) Geologische Reisenotizen aus Ecuador. Ein Beitrag zur Kenntnis der typischen Andesitgesteine. [Geological travel notes from Ecuador. A contribution to the knowledge of the typical andesite rock types]. *Neues Jahrb. Mineral. Geol. Paläontol.*, Supplement, Vol. 4, pp. 195-227.

- 812.**SIEVERS W. (1914) Reise in Perú und Ecuador, ausgeführt 1909. [Travel in Perú and Ecuador, undertaken in 1909]. *Wiss. Veröff. Ges. Erdkd. Leipzig*, Vol. 8. Spanish translation of the sections relating to Ecuador, pp. 145-161, 215-221, by MARTÍNEZ A. *An. Univ. Cent. Ecuador*, 1933, Vol. 51, No. 285, pp. 123-141. [Following earlier authors, the Tertiary sediments of the Cuenca Basin are regarded as Cretaceous].
- 813.**SIGAL J. (1967) *Reporte del estudio estratigráfico*. [Stratigraphical study report]. (Quito: Instituto Francés del Petróleo; Servicio Nacional de Geología y Minería)
- 814.**SIGAL J. (1968) *Estratigrafía micropaleontológica del Ecuador, datos anteriores y nuevos*. [Micropaleontological stratigraphy of Ecuador, old and new data]. (Quito: Instituto Francés del Petróleo; Servicio Nacional de Geología y Minería). [An important publication, unfortunately with a limited distribution, which includes the first details of some of the Cretaceous sediments in the Andes].
- 815.**SIGAL J. (1969) Quelques acquisitions récentes concernant la chronostratigraphie des formations sédimentaires de l'Equateur. [Some recent knowledge concerning the chronostratigraphy of sedimentary formations of Ecuador]. *Rev. Esp. Micropaleontol.*, Vol. 1, No. 2, pp. 205-236. [An illustrated resumé of the work of the Institut Français du Pétrole which incorporates material from 291, 292, 293, 754, 755 and 756].
- 816.**SIGAL J. (1972) Estudio micropaleontológico de las Formaciones de la región costanera del Ecuador. [Micropaleontological study of the Formations of the coastal region of Ecuador]. Bureau d'études Industrielles et Coopération de l'Institut Français du Pétrole (Cuarta misión, 1971). Ref. 304042, pp. 1-13. [Lists the larger foraminifera of the Las Delicias Limestone, and also the foraminifera from the Angostura Formation of the Río Banchal of Manabí].
- 817.**SILLITOE R. H. (1974) Tectonic segmentation of the Andes: implication for magmatism and metallogeny. *Nature, London*, Vol. 250, pp. 542-545.
- 818.**SIMKIN T. (1972) The origin of some flat-topped volcanoes and guyots. *Mem. Geol. Soc. Am.*, Vol. 132, pp. 183-193.
- 819.**SIMKIN T. (1978) Volcanology. *Geotimes*, Vol. 21, No. 1, p. 38.
- 820.**SIMKIN T. and FISKE R. S. (1977) Volcanology. *Geotimes*, Vol. 22, No. 1, pp. 42-43.
- 821.**SIMKIN T. and HOWARD K. A. (1968) *The collapse of Fernandina caldera, Galápagos Islands*. (Washington D.C.: Smithsonian Institute Centre for Short-Lived Phenomena).
- 822.**SIMKIN T. and HOWARD K. A. (1970) A caldera collapse in the Galápagos Islands, 1968. *Sci. New York*, Vol. 169, No. 3944, pp. 429-437.
- 823.**SIMPSON B. B. (1975) Pleistocene changes in the flora of the high tropical Andes. *Paleobiology*, Vol. 1, pp. 273-294. [Contains little specific information on Ecuador, but nevertheless the general implications are important].
- 824.**SINCLAIR J. H. (1923) Oil developments in Ecuador. *Proc. Am. Inst. Min. Metall. Eng.*, Vol. 69, pp. 79-96.
- 825.**SINCLAIR J. H. (1928) Geología de la región Oriental del Ecuador. *An. Univ. Cent. Ecuador*, Vol. 40, No. 264, pp. 241-281.
- 826.**SINCLAIR J. H. (1929) In the land of cinnamon: a journey in eastern Ecuador. *Geogr. Rev.*, Vol. 19, No. 2, pp. 201-217. Spanish translation by GUERRERO J. *Bol. Mens. Minist. Obras. Publ. Quito*, 1937, Vol. 2, Nos. 18-20, pp. 99-109.
- 827.**SINCLAIR J. H. (1932) Eruptions of the volcano Tungurahua in Ecuador. *Geogr. Rev.*, Vol. 22, pp. 677-678.
- 828.**SINCLAIR J. H. and BERKEY C. P. (1923) Cherts and igneous rocks of the Santa Elena Oil Field Ecuador. *Trans. Am. Inst. Min. Metall. Eng.*, Vol. 69, pp. 79-95. Spanish translation by GUERRERO J. *Bol. Mens. Minist. Obras. Publ. Quito*, 1937, Vol. 2, Nos. 18-20, pp. 111-117.
- 829.**SINCLAIR J. H. and BERKEY C. P. (1924) Geology of Guayaquil, Ecuador, South America. *Am. J. Sci. Ser. 5*, Vol. 7, No. 42, pp. 491-497. Spanish adaptation by MARTÍNEZ, A. *An. Univ. Cent. Ecuador*, 1934, Vol. 53, No. 289, pp. 199-208. Spanish translation by GUERRERO J. *Bol. Mens. Minist. Obras. Publ. Quito*, 1937, Vol. 2, Nos. 18-20, pp. 79-81. [The 'Cherty limestones of Guayaquil' (Guayaquil Member of the Cayo Formation), named. First Cretaceous microfauna in Ecuador, noted].
- 830.**SINCLAIR J. H. and WASSON T. (1923) Explorations in eastern Ecuador. *Geogr. Rev.*, Vol. 13, pp. 190-210. Spanish translation. *Bol. Mens. Minist. Obras. Publ. Quito*, 1937, Vol. 2, Nos. 18-20, pp. 33-47.
- 831.**SINGEWALD J. T. Jr. (1934) The lead and zinc resources of the Pacific coast countries of South America. *Proc. 5th Pac. Sci. Congr., Canada*, 1933, Vol. 2, pp. 1431-1448.
- 832.**SINGEWALD J. T. Jr. (1943) Bibliography of economic geology of South America. *Spec. Pap. Geol. Soc. Am.*, Vol. 50. [Ecuador pp. 121-123].
- 833.**ŠKVR V. (1972) Hlavní rysy geologické stavby a prognóza rudních zón v Ecuador. [Main features of the geological structures and characteristics of the ore zones in Ecuador]. *Geol. Průzkum Čes.*, Vol. 14, No. 10, pp. 305-307.
- 834.**SMALL J. Jr (1962) Stratigraphic and Ancon oil fields studies, southwest Ecuador. Ph.D thesis, University of Colorado. [A useful synthesis and reinterpretation of much unpublished oil company information – needs now to be read in the light of 209. *Micropaleontology* by Polugar].
- 835.**SMITH J. A. (1946-1947) Informes geológicos y geofísicos de la Internacional Ecuadorian Petroleum Co., Concesiones: 1. Morris-Hudson (dic. 1946); 2. Wallis-Boyer (dic. 1946); 3. Opcional de Telemi (en. 1947); 4. Petrolera (mar. 1947); 5. von Buchwald (mar. 1947). [Geological and geophysical reports of the International Ecuadorian Petroleum Co., Concessions: 1. Morris-Hudson (December. 1946); 2. Wallis-Boyer (December. 1946); 3. Telemi option (January. 1947); 4. Petrolera (March. 1947); 5. von Buchwald (March. 1947)]. Unpublished report of the Dirección de Minería y Petróleo, Ministerio Económico, Quito. [See remarks under 181].
- 836.**SMITH W. G., CRUZ-OROZCO R. and RODRÍGUEZ D. (1971) Coastal environments of the Gulf of Guayaquil region of Ecuador [Abstract]. P. 211 in *2nd Coastal Shallow Water Ref. Conf. Baton Rouge, Louisiana; Newark, Delaware; Los Angeles, California*, Abstr. No. 2. (Los Angeles: University Press).
- 837.**SNELLING N. J. (1970) K:Ar age determinations on samples from Ecuador. *Rep. Geochem. Div., Inst. Geol. Sci.*, No. 70. 10 [Unpublished]. [The first of an important series of reports by the IGS. Most of these dates published in 356 – see also 104, 480 and 838].
- 838.**SNELLING N. J., INGRAM I. H. and CHAN K. P. (1970) K:Ar age determinations on samples from Ecuador. *Rep. Geochem. Div., Inst. Geol. Sci.*, No. 70.18 [Unpublished]. [The Macará granodiorite, Loja province, dated.].
- 839.**SOCIÉTÉ ANONYME DE PROSPECTION AÉROPORTÉE (1965) *Estudio aerogeofísico de la Sierra Austral. República del Ecuador*. [Aerogeophysical study of the southern Sierra, Ecuador] (Quito: Dirección General de Geología y Minas). [Geophysical maps of the areas of the southern Andes investigated by the U.N., produced, but no text, to the author's knowledge].
- 840.**SPILLMANN F. (1929a) Das letzte Mastodon von Südamerika. [The last Mastodon in South America]. *Nat. Mus., Frankfurt*. Vol. 59, No. 2, pp. 119-123. [See 427 for a synthesis of all the known Ecuadorian Pleistocene mammals]

- 841.** SPILLMANN F. (1929b) Das südamerikanische Mastodon als Zeitgenosse des Menschen majoiden Kulturkreises. [The South American Mastodon as a contemporary of civilised man]. *Paläontol. Z.*, Vol. 2, No. 2, pp. 170-177. [See remarks for 840].
- 842.** SPILLMANN F. (1931) *Die Säugetiere Ecuadors im Wandel der Zeit (1. Teil)*. [The mammals of Ecuador with the change of time (Part I)] (Quito: Universidad Central). [See remarks for 840].
- 843.** SPILLMANN F. (1938) Die fossilen Pferde Ekuadors der Gattung *Neohippus*. [The fossil horses of Ecuador of the species *Neohippus*]. *Palaeobiologica*, Vol. 6, pp. 372-393. [See remarks for 840].
- 844.** SPILLMANN F. (1941) Über einen neuen hydrochoeren Reisennager aus dem Pleistozän von Ecuador. [Concerning a new giant water rodent from the Pleistocene of Ecuador]. *J. Geol. Soc., Tokyo*, Vol. 48, No. 571 pp. 196-201. [See remarks for 840].
- 845.** SPILLMANN F. (1942) Contribución al conocimiento de fósiles nuevos de la avifauna ecuatoriana en el Pleistoceno de Santa Elena. [Contribution to the knowledge of new fossils of the Ecuadorian avifauna in the Pleistocene of Santa Elena]. *Pros. 8th Am. Sci. Congr. Washington*, Vol. 4, pp. 375-389.
- 846.** SPILLMANN F. (1948) Beiträge zur Kenntnis eines neuen gravigraden Riesensteppentieres (*Eremotherium carolinense* gen. et sp. nov.), seines Lebensraumes und seiner Lebensweise. [Contribution to the knowledge of a new giant desert gravigrade (*Eremotherium carolinense* gen. et sp. nov.) its living areas and way of living]. *Palaeobiologica*, Vol. 8, pp. 231-279. [See remarks for 840].
- 847.** SPINDLER J. P. and HERRERA J. I. (1959a) Reconocimiento geológico de la zona mineralizada del Fierro Urco, Provincia de Loja. [Geological reconnaissance of the mineralised zone of Fierro Urco, Loja Province]. Unpublished report of the Misión Franco-Ecuatoriana, Dirección General de Minas e Hidrocarburos, Quito.
- 848.** SPINDLER J. P. and HERRERA J. I. (1959b) Reconocimiento geológico de los mármoles de Saraguro-Paquishapa, Provincia de Loja. [Geological inspection of the marbles of Saraguro-Paquishapa, Loja Province]. Unpublished report of the Misión Franco-Ecuatoriana, Dirección General de Minas e Hidrocarburos, Quito.
- 849.** SPINDLER J. P., MANGEZ G., MOSQUERA C. and HERRERA J. I. (1959) Los carbones de Malacatos y Loja [The coals of Malacatos and Loja]. Unpublished report of the Misión Franco-Ecuatoriana, Dirección General de Minas e Hidrocarburos, Quito. [See also 479, 648, 681 and 907].
- 850.** SPRUCE R. (1861) The mountains of Llanganati in the Quitoian Andes. *J.R. Geogr. Soc.*, Vol. 31, pp. 163-184.
- 851.** STAINFORTH R. M. (1948) Applied micropalaeontology in coastal Ecuador. *J. Paleontol.*, Vol. 22, No. 2, pp. 113-151. [An important contribution to the stratigraphical palaeontology of coastal Ecuador. Many stratal names introduced in internal reports of the Internatioanl Ecuadorian Petroleum Co. published here]
- 852.** STAINFORTH R. M. (1949a) The age of the *Hannatoma* mollusc fauna of South America. A symposium. *J. Paleontol.*, Vol. 23, No. 2, p. 145. [A symposium to try to resolve the differing ages given by the *Hannatoma* molluscs and the associated foraminifera. Problem resolved in Ecuador in 126 – see also 490, 574, 774]
- 853.** STAINFORTH R. M. (1949b) The *Hannatoma* fauna in the Zapotal sands of southwest Ecuador. *J. Paleontol.*, Vol. 23, No. 2, pp. 155-156. [See remarks for 852].
- 854.** STAINFORTH R. M. (1953) The basis of Paleogene correlation of middle America. *Bol. Soc. Geol. Perú*, Vol. 26, pp. 247-261. [Most of the 'Oligocene' deposits of this paper are now regarded as Miocene].
- 855.** STAINFORTH R. M. (1968) Mid-Tertiary diastrophism in northern South America. Pp. 159-177 in *Trans 4th Caribb. Geol. Congr. (1965)*. SAUNDERS J.B. (Editor). [Ecuador: pp. 162-163. *Palaeontology and stratigraphy basically that of 851*].
- 856.** STAINFORTH R. M. and STEVENSON F. V. (1946) Three new foraminifera from the Tertiary of Ecuador. *J. Paleontol.*, Vol. 20, No. 6, pp. 560-565. [Three arenaceous species described from the Playa Rica, San Pedro and 'Charapotó' Formations].
- 857.** STEWART A. (1915) Further observations on the origin of the Galápagos Islands. *Plant World*, Vol. 18, pp. 192-200.
- 858.** STOLL W. C. (1962) Notes on the mineral resources of Ecuador. *Econ. Geol.*, Vol. 57, No. 5, pp- 799-808. [A useful summary].
- 859.** STOSE G. W. (1950) Geological map of South America. 1:5000000. (Geological Society of America).
- 860.** STRAUSS L. W. (1930) Recent progress in the mineral industry of South America. *Min. Metall. New York*, Vol. 11, No. 285, pp. 428-434.
- 861.** STÜBEL A. (1873) *Carta del Dr. A. Stübel a S.E. el Presidente de la República sobre sus viajes a las montañas Chimborazo, Altar, etc... y en especial sobre sus ascensiones al Tungurahua y Cotopaxi*. [Letter of Dr. A. Stübel to His Excellency, the President of the Republic, concerning his travels to the mountains of Chimborazo, Altar, etc...and, in particular, his ascents of Tungurahua and Cotopaxi] (Quito).
- 862.** STÜBEL A. (1886) *Skizzen aus Ecuador*. [Sketches from Ecuador]. (Berlin: Asher).
- 863.** STÜBEL A. (1897) Die Vulkanberge von Ecuador, geologisch-topographisch aufgenommen und beschrieben. [The volcanic mountains of Ecuador, geologically-topographically surveyed and described] (Berlin: Asher). Spanish translation of part by MARTÍNEZ A. *An. Univ. Cent. Ecuador*, 1905, Vol. 20, No. 138, pp. 33-49; No. 140, pp. 110-127; No. 141, pp. 155-168; Vol. 21, No. 145, pp. 68-79.
- 864.** STÜBEL A. (1900) Les volcans de l'Equateur. Résumé des théories d'intérêt général contenues dans cet ouvrage, par W. Prinz. [The volcanoes of Ecuador. Summary of theories of general interest contained in this work, by W. Prinz]. *Bull. Soc. Belg. Géol., Paleontol. Hydrol.*, Vol. 14, pp. 51-81.
- 865.** STÜBEL A. (1902) Über die Verbreitung der hauptsächlichen Eruptionszentren und der sie kennzeichnenden Vulkanbergen in Südamerika. [Concerning the distribution of the major centres of eruption and their distinguishing volcanoes in South America]. *Petermanns Mitt.*, Vol. 48, pp. 1-9. Spanish translation by MARTÍNEZ A. *An Univ. Cent. Ecuador*, 1903, Vol. 18, No. 127, pp. 122-128; No. 128, pp. 217-227.
- 866.** STÜBEL A. (1903) Karte der Vulkanberge Antisana, Chacana, Sincholagua, Quilindaña, Cotopaxi, Rumiñahui und Pasochoa. [Map of the volcanoes Antisana, Chacana, Sincholagua, Quilindaña, Cotopaxi, Rumiñahui and Pasochoa] (Leipzig). Spanish translation by MARTÍNEZ A. *An. Univ. Cent. Ecuador*, 1905, Vol. 19, pp. 339-352.
- 867.** STUEBY C. (1945) Contribuciones para el conocimiento geológico de la región azuaya. [Contributions for the geological knowledge of the Azuay region]. *An. Univ. Cuenca*, Vol. 1.
- 868.** SUESS E. (1897-1913) *La face de la Terre*. 5 vol. [French translation by MARGERIE E. DE of *Das Antlitz der Erde*] (Paris: Colin).
- 869.** SULLIVAN L. R. and HELLMAN M. (1925) The Punín Calvarium. *Anthropol. Pap. Am. Mus. Nat. Hist.*, Vol. 23, Pt. 7, pp. 309-324.
- 870.** SUTTON A. J. A. (1954) General geological report on A.E.O. Ltd. Properties. *Geol. Rep. Anglo Ecuadorian Oilfields Ltd.*, No. 57. [Unpublished]. [Not a very important report; one new stratal term (Santa Paula Cherts) of dubious value introduced].

871.SUTTON E. M. (1959) Geology of the Colonche Hills, Julio Moreno and Dos Bocas area: Progreso Basin, Guayas Province, Ecuador. Unpublished geological report of the California Ecuador Petroleum Co. [A useful report with map; several stratal terms (Bellavista Limestone, Basal Conglomerate, Las Masas Formation) introduced].

872.SWANSON F. J., BAITUS H. W., LEXA J. and DYMOND J. (1974) Geology of Santiago, Rabida and Pinzón Islands, Galápagos. *Bull. Geol. Soc. Am.*, Vol. 85, pp. 1803-1810.

T

873.TAKEDA H. (1968) Reconocimiento geológico de la región de la mina 'Macuchi' en la Provincia de Cotopaxi. [Geological Survey of the region of the 'Macuchi' mine in the Province of Cotopaxi], *Maclas. Univ. Cent. Ecuador*, No. 1.

874.TANNHÄUSER F. J. (1904) Die jüngeren Gesteine der ecuatorianischen Ost-Cordillere von Cordillera de Pillaro bis zum Sangay sowie die des Azuay und eines Teiles der Cuenca-Mulde. [The younger rocks of the eastern Cordillera of Ecuador from the Cordillera de Pillaro to Sangay, as well as Azuay and part of the Cuenca basin]. Inaugural dissertation University of Berlin. [Included in Reiss, 1901-1904].

875.TAN SIN HOK (1936) Zur Kenntnis der Miogypsiniden. [To the knowledge of the Miogypsinidae]. *Ing. Ned.-Indië*, Vol. 3, pt. 3, pp. 45-61.

876.TELLINI A. (1889) Nummuliti della Repubblica dell'Equatore. [Nummulites from the Republic of Ecuador]. *Boll. R. Comit. Geol. Ital.*, Vol. 20, No. 7-8, pp. 252-255. [Of historic interest only. He records various larger foraminifera in an unlocated sample from Ecuador. All the foraminifera are compared with European species, none of which occur in South America].

877.THALMANN H. E. (1943) Upper Cretaceous limestones near San Juan, province of Chimborazo (western Andes) Ecuador. *Bull. Geol. Soc. Am.*, Vol. 54, No. 12, pp. 1827-1828. [An important paper establishing without doubt the presence of marine Upper Cretaceous rocks in the Andes].

878.THALMANN H. E. (1944) Notas sobre estudios micropaleontológicos de las Formaciones cretáceas y terciarias en la región litoral del Ecuador. [Notes concerning micropalaeontological studies of the Cretaceous and Tertiary Formations in the coastal region of Ecuador]. *Bol. Inst. Sudam. Pet.*, Vol. 1, No. 3, pp. 201-206.

879.THALMANN H. E. (1945a) Resumen de las investigaciones micropaleontológicas en el Ecuador. [Summary of Micropalaeontological studies in Ecuador]. *Ecuador Pet., Quito*, Vol. 1, No. 1, pp. 22-24. [A useful historical survey of micropalaeontological work in Ecuador].

880.THALMANN H. E. (1945b) Breves apuntes sobre la historia de la micropaleontología en el Ecuador, durante los últimos cincuenta años. [Brief notes on the history of micropalaeontology in Ecuador, during the last fifty years]. *Bol. Inst. Sudam. Pet.*, Vol. 2, No. 1, pp. 113-119. [Reproduction of 879].

881.THALMANN H. E. (1946a) Micropaleontology of Upper Cretaceous and Paleocene in western Ecuador. *Bull. Am. Assoc. Pet. Geol.*, Vol. 30, No. 3, pp. 337-347. [An important paper dating the Cayo Formation as Upper Cretaceous – see also 145].

882.THALMANN H. E. (1946b) Foraminiferal genus *Rzehakina* in western Ecuador. *Bull. Geol. Soc. Am.*, Vol. 57, No. 12, p. 1235.

883.THALMANN H. E. (1946c) Micropaleontology of Miocene Progreso Formation, southwestern Ecuador. *Bull. Geol. Soc. Am.*, Vol. 57, No. 12, p. 1236. [The first note on the micropalaeontology of this Formation].

884.THALMANN H. E. (1946d) Fossil radiolarian beds of southwestern Ecuador. *Bull. Geol. Soc. Am.*, Vol. 57, No. 12, p. 1285. [One of the first notes on the radiolaria of Ecuador].

885.THALMANN H. E. (1946e) Mitteilungen über Foraminiferen [Information concerning foraminifera] V. *Eclogae Geol. Helv.*, Vol. 39, No. 2, pp. 309-314. 20. Vorkommen von *Rotalia skourensis* Pfender in der ober-kretazischen Guayaquil-Formation von Ecuador [Presence of *Rotalia skourensis* Pfender in the Upper Cretaceous Guayaquil Formation of Ecuador], pp. 309-310. 21. Vorkommen der Gattung *Hantkenina* in West-Ecuador. [Presence of the species *Hantkenina* in western Ecuador], pp. 310-311. 22. Über *Globotruncana renzi* Thalmann 1942 und *Gandolfi* 1942. [Concerning *Globotruncana renzi* Thalmann 1942 and *Gandolfi* 1942] pp. 311-312. 24 *Miogypsina*-Vorkommen in West-Ecuador [Presence of *Miogypsina* in western Ecuador], pp. 312-314.

886.THALMANN H. E. (1947) Mitteilungen über Foraminiferen [Information concerning foraminifera]. VI. *Eclogae Geol. Helv.*, Vol. 40, No. 2, pp. 366-372. 25. Oberoligozäne Foraminiferenfauna von Jaramijó (Ecuador). [Upper Oligocene foraminifera fauna from Jaramijó (Ecuador)], pp. 366-368. 26. Das geologische Alter der Guayaquil-Formation in Ecuador. [The geological age of the Guayaquil Formation in Ecuador], p. 368. 27. Stratigraphische Verbreitung der Gattung *Halkyardia* Heron-Allen & Earland. [Stratigraphical distribution of the genus *Halkyardia* Heron-Allen & Earland.], pp. 368-369.

887.THALMANN H. E. (1949) Regional-stratigraphische Verbreitung der Foraminiferen Gattung *Rzehakina* Cushman, 1927 [Regional, stratigraphical distribution of the foraminiferal genus *Rzehakina* Cushman, 1927]. *Eclogae Geol. Helv.*, Vol. 42, No. 2, pp. 506-507.

888.THOMAS J. E. and CRAINE L. (1969) Atmospheric sound signal from Galápagos volcanic eruption of 11 June 1968 [Abstract]. *Trans. Am. Geophys. Union*, Vol. 50, p. 255.

889.TIRADO R. and ROBALINO F. (1978) Ecuador: 72000 km² de territorio ecuatoriano son consideradas de altas posibilidades para la exploración hidrocarburífera. *Pet. Int.*, Vol. 36, No. 12. Pp. 31-34.

890.TOM E. C. K., MIRAFUENTE N. T. and ESTRELLA E. (1976) A stability study of a concrete arch dam rock abutment. Pp. 264-281 in *Rock engineering for foundation and slopes; proceedings of a speciality conference*. Vol. 1. (New York: American Society of Civil Engineers).

891.TOMKINS H. K. V. (1941) Petroleum development against historic background of Ecuador. *World. Pet.*, Vol. 12, No. 9, pp. 80-83.

892.TORO TERÁN G. (1952) Informes sobre los yacimientos de hierro en el Ecuador. [Reports concerning the deposits of iron in Ecuador]. *19th Int. Geol. Congr., Algeria*, Vol. 1, p. 369.

893.TORRES M. (1973) Plioceno en el suroeste de Manabí 'Formación Canoa'. [Pleistocene in the south-west of Manabí, 'Formation Canoa']. *Rev. Dir. Gen. Geol. Minas, Quito*, Vol. 2, No. 5, pp. 14-17.

894.TORRES O. E. (1931) Nuevo análisis de las aguas del cráter-lago 'Quilotoa'. [New analysis of the Waters of the crater-lake 'Quilotoa']. *An. Univ. Cent. Ecuador*, Vol. 47, No. 277, pp. 25-27.

895.TSCHOPP H. J. (1945) Bosquejos de la geología del Oriente Ecuatoriano. [Sketches of the geology of the Ecuadorian Oriente]. *Bol. Inst. Sudam. Pet.*, Vol. 1, No. 5, pp. 466-484.

896.TSCHOPP H. J. (1948) Geologische Skizze von Ekuador. [Geological sketch of Ecuador]. *Bull. Assoc. Suisse Géol. Ing. Pét.*, Vol. 15, No. 48, pp. 14-45.

897. TSCHOPP H. J. (1953) Oil explorations in the Oriente of Ecuador, 1938-1950. *Bull. Am. Assoc. Pet. Geol.*, Vol. 37, No. 10, pp. 2303-2347.
898. TSCHOPP H. J. (1956) Upper Amazon Basin geological province. Pp. 253-267 in *Handbook of South American geology. Mem. Geol. Soc. Am.*, Vol. 65.

U

899. UHLE M. (1930) Späte Mastodonten in Ecuador. [Late Mastodons in Ecuador]. *Proc. 23rd Int. Congr. Americanist (Sept. 1928)*, pp. 247-258. [See 427 for a synthesis of all the known Ecuadorian Pleistocene mammals].
900. UNITED NATIONS DEVELOPMENT PROGRAMME (1968) *Survey of hydrological resources of Manabí Province, Ecuador*. 68 pp. (New York: United Nations).
901. UNITED NATIONS DEVELOPMENT PROGRAMME (1969a) Survey of metallic and non-metallic minerals. Copper-molybdenum mineralization, Chaucha. *Ad Hoc. Rep., U.N. Dev. Programme, Quito-New York*, No. 1; published in Spanish as *Publ. Dir. Gen. Geol. Minas, Quito*, No. 7. [See also 604, 609].
902. UNITED NATIONS DEVELOPMENT PROGRAMME (1969b) Survey of metallic and non-metallic minerals. Gualleturo silver prospects, Cañar province. *Ad Hoc. Rep., U.N. Dev. Programme, Quito-New York*, No. 2.
903. UNITED NATIONS DEVELOPMENT PROGRAMME (1969c) Survey of metallic and non-metallic minerals. Iron-sulphide mineralization, San Fernando, Azuay. *Ad Hoc. Rep., U.N. Dev. Programme, Quito-New York*, No. 3.
904. UNITED NATIONS DEVELOPMENT PROGRAMME (1969d) Survey of metallic and non-metallic minerals. Coal investigations (Operation No. 1, Cuenca-Biblián and Loja). *Tech. Rep., U.N. Dev. Programme, Quito-New York*, Annex No. 1. [Based on 649].
905. UNITED NATIONS DEVELOPMENT PROGRAMME (1969e) Survey of metallic and non-metallic minerals. Gold and base metal sulphides. Operation No. 2, Portovelo. *Tech. Rep., U.N. Dev. Programme, Quito-New York*, Annex No. 2; published in Spanish as: *Publ. Dir. Gen. Geol. Minas, Quito*, No. 8.
906. UNITED NATIONS DEVELOPMENT PROGRAMME (1969f) Survey of metallic and non-metallic minerals. Clays and Travertine (Operation No. 3, Cuenca). *Tech. Rep., U.N. Dev. Programme, Quito-New York*, No. 3 Annex No. 3. [See also 627].
907. UNITED NATIONS DEVELOPMENT PROGRAMME (1969g) Survey of metallic and non-metallic minerals. Glass sands and quartz (Operation No. 4 – Santa Elena Peninsula and Portovelo). *Tech. Rep., U.N. Dev. Programme, Quito-New York*, No. 4. Annex No. 4.
908. UNITED NATIONS DEVELOPMENT PROGRAMME (1969h) Survey of metallic and non-metallic minerals. Exploration and preliminary evaluation of metallic deposits (Operation No. 5 – Austro). *Tech. Rep., U.N. Dev. Programme, Quito-New York*, No. 5.
909. UNITED NATIONS DEVELOPMENT PROGRAMME (1969i) Survey of metallic and non-metallic minerals. Iron-ore and barite (Operation No. 7 – Guayas – Manabí). *Tech. Rep., U.N. Dev. Programme, Quito-New York*, No. 6, Annex No. 6.
910. UNITED NATIONS DEVELOPMENT PROGRAMME (1969j) Survey of metallic and non-metallic minerals. Geochemical exploration 1965-1969. *Tech. Rep., U.N. Dev. Programme, Quito-New York*, No. 3.
911. UNITED NATIONS DEVELOPMENT PROGRAMME (1971) Survey of metallic and non-metallic minerals. Exploration and preliminary evaluation of metallic mineral deposits. *Tech. Rep., U.N. Dev. Programme, Quito-New York*, No. 5, Annex No. 5.
912. UNITED NATIONS DEVELOPMENT PROGRAMME (1972a) Survey of metallic and non-metallic minerals. (Phase II). The Ger silver prospect. Also in Spanish. [Prospecto de plata de Ger]. *Tech. Rep., U.N. Dev. Programme, New York*, No. 10.
913. UNITED NATIONS DEVELOPMENT PROGRAMME (1972b) Survey of metallic and non-metallic minerals. (Phase II). Geochemical and geological investigations between Cochancay and Joyapal. Also in Spanish. [Investigaciones geoquímicas y geológicas entre Cochancay y Joyapal] *Tech. Rep., U.N. Dev. Programme, New York*, No. 10.
914. UNITED NATIONS DEVELOPMENT PROGRAMME (1972c) Survey of metallic and non-metallic minerals. (Phase II). Geochemical and geological investigations at Yanuncay. Also in Spanish. [Investigaciones geoquímicas y geológicas en Yanuncay]. *Tech. Rep., U.N. Dev. Programme, New York*, No. 11.
915. UNITED NATIONS DEVELOPMENT PROGRAMME (1972d) Survey of metallic and non-metallic minerals. (Phase II). Geochemical, geological and geophysical investigations near San Miguel (Azogues). Also in Spanish. [Investigaciones geoquímicas, geológicas y geofísicas cerca de San Miguel (Azogues)]. *Tech. Rep., U.N. Dev. Programme, New York*, No. 12.
916. UNITED NATIONS DEVELOPMENT PROGRAMME (1972e) Survey of metallic and non-metallic minerals. (Phase II). Exploration for metallic minerals in southern Ecuador. *Tech. Rep., U.N. Dev. Programme, New York*, No. 13.
917. UNITED NATIONS DEVELOPMENT PROGRAMME (1972f) Survey of metallic and non-metallic minerals. (Phase II). Exploration for metallic minerals in southern Ecuador. Also in Spanish. [Exploración de minerales metálicos al Sur del Ecuador]. *Tech. Rep., U.N. Dev. Programme, New York*, No. 14.
918. UNITED NATIONS DEVELOPMENT PROGRAMME (1972g) Survey of metallic and non-metallic minerals. (Phase II). The Peruvín and El Rosario silver prospects. Also in Spanish. [Prospectos de plata en Perrín y El Rosario]. *Tech. Rep., U.N. Dev. Programme, New York*, No. 15.
919. UNITED NATIONS DEVELOPMENT PROGRAMME (1972h) Survey of metallic and non-metallic minerals. (Phase II). Polymetallic mineralization at Angas. Also in Spanish. [Mineralización polimetálica en Angas]. *Tech. Rep., U.N. Dev. Programme, New York*, No. 16.
920. UNITED NATIONS DEVELOPMENT PROGRAMME (1972i) Survey of metallic and non-metallic minerals. (Phase II). The San Bartolomé silver prospect. Also in Spanish. [El prospecto de plata en San Bartolomé]. *Tech. Rep., U.N. Dev. Programme, New York*, No. 17. [Based on the unpublished report 345].

V

921. VAN ANDEL T., HEATH G. R., MALFAIT B. T. HEINRICHS D. F., and EWING J. I. (1971) Tectonics of the Panama Basin, eastern equatorial Pacific. *Bull. Geol. Soc. Am.*, Vol. 82, pp. 1489-1508.
922. VAN DER HAMMEN T. (1974) The Pleistocene changes of vegetation and climate in tropical South America. *J. Biogeogr.*, Vol. 1, pp. 3-26. [Primarily concerned with Colombia, but indirectly relevant to Ecuador].
923. VAUGHAN T. W. (1924) American and European Tertiary larger foraminifera. *Bull. Geol. Soc. Am.*, Vol. 35, pp. 785-822.
924. VAUGHAN T. W. (1925) Recent additions to knowledge of the correlations of the Tertiary geologic formations of north-eastern Mexico, Central America, the West Indies, northern South America and Lower California. *Proc. Pan. Pac. Sci. Congr. Aust. 1923*, Vol. 1, pp. 864-870. [Larger foraminifera from the Socorro 'Formation' discussed].

925. VAUGHAN T. W. (1926) Foraminifera from the Upper Eocene deposits of the coast of Ecuador. *Proc. Natl. Acad. Sci. U.S.A.*, Vol. 12, No. 8, pp. 533-535. [Larger foraminifera from the Socorro 'Formation' discussed].
926. VAUGHAN T. W. (1928) Results of recent investigations of American Tertiary larger foraminifera. *Proc. 3rd. Pan. Pac. Sci. Congr. Tokyo 1926*, Vol. 2, pp. 1850-1857.
927. VAUGHAN T. W. (1937) The Tertiary foraminifera of south-west Ecuador. Pp. 150-175 in *The geology of south-western Ecuador*. SHEPPARD G. (London: Murby).
928. VILLEMUR J. (1966) Reconocimiento geológico y minero del Sur de la Provincia de Loja. [Geological and mining inspection of the southern Loja Province]. Unpublished report of Servicio Nacional de Geología y Minería, Quito.
929. VILLEMUR J. (1967) Estudio de reconocimiento geológico-mineralógico de la Provincia de Loja. Unpublished report of Servicio Nacional de Geología y Minería, Quito. [Several stratigraphic names, which have not been adopted by subsequent authors (e.g. 479), introduced for an area which at that time had been little studied].
930. VINTON R. W. (1951) Origin of life on the Galápagos Islands. *Am. J. Sci.*, Vol. 249, No. 5, pp. 356-376.
- VISSE S., see WISSE S.
931. VOGT P. R. and JOHNSON G. L. (1973) Marine telechemistry. *Nature, London*, Vol. 245, pp. 373-375.
- ## W
932. WAGNER A. (1860) Über fossile Säugetierknochen am Chimborazo. [On the fossil mammalian bones of Chimborazo]. *Sitzungsber. K. Bayerischen Akad. Wiss. München*, 1860, pp. 330-338.
933. WAGNER M. (1865) Die Vulkane und Kegelberge der westlichen Cordillere von Quito. [The volcanoes and cones of the western Cordillera of Quito]. *Westermanns. Monatsh.*, Okt. 1865, pp. 276-293.
934. WAGNER M. (1866) Studien und Erinnerungen aus den Anden von Ecuador. I. Der Vulkan Cotopaxi und seine Umgebungen. [Studies and recollections of the Andes of Ecuador. I. Cotopaxi volcano and its surroundings]. *Das Ausland*, No. 27, pp. 625-631; No. 28, pp. 651-658.
935. WAGNER M. (1870) *Naturwissenschaftliche Reisen im tropischen Amerika*. [Scientific expeditions in tropical America]. (Stuttgart: Cotta).
936. WARREN C. R., SCHMIDT D. L., DENNY C. S. and DALE W. J. (1969) A descriptive catalog of selected aerial photographs of geologic features in areas outside the United States. *Prof. Pap. U.S. Geol. Surv.*, No. 591. [Ecuador, pp. 15-16].
937. WASHINGTON H. S. and KEYES M. G. (1927) Rocks of the Galápagos Islands. *J. Washington Acad. Sci.*, Vol. 17, No. 21, pp. 538-543.
938. WASSON T. and SINCLAIR J. H. (1927) Geological explorations east of the Andes in Ecuador. *Bull. Am. Assoc. Pet. Geol.*, Vol. 11, No. 12, pp. 1253-1281. Spanish translation by GUERRERO J. *Bol. Mens. Minist. Obras Publ., Quito*, 1937, Vol. 2, No. 19-20, pp. 55-77.
939. WATTS A. B. and COCHRAN J. R. (1974) Gravity anomalies in the Galápagos Islands. *Sci., New York*, Vol. 184, pp. 808-809.
940. WATTS A. B. and COCHRAN J. R. (1974) Gravity anomalies in the Galápagos Islands area. *Science, New York*, Vol. 184, pp. 808-809.
941. WEAVER C. E. (1940) A general summary of the Mesozoic of South America and Central America. *Proc. 8th Am. Sci. Congr., Washington*, Vol. 4, pp. 149-193. [Contains a brief account (p. 169) of the geology of the Oriente (see also correlation chart between pp. 152-153)].
942. WEEKS L. G. (1947a) Highlights on developments in foreign petroleum fields. *Bull. Am. Assoc. Pet. Geol.*, Vol. 31, No. 7, pp. 1135-1193. [Ecuador, p. 1156].
943. WEEKS L. G. (1947b) Paleogeography of South America. *Bull. Am. Assoc. Pet. Geol.*, Vol. 31, No. 7, pp. 1194-1241.
944. WEEKS L. G. (1948) Paleogeography of South America. *Bull. Am. Assoc. Pet. Geol.*, Vol. 59, No. 3, pp. 249-282.
945. WEISS R. F., LONSDALE P., LUPTON J. E., BAINBRIDGE A. E. and CRAIG H. (1977) Hydrothermal plumes in the Galápagos Rift. *Nature, London*, Vol. 267, pp. 600-603.
946. WENZ S. (1973) Présence du Séacien *Ptychodus* (*Pt. chappelli*) dans le Crétacé supérieur de l'Équateur (Amérique du Sud). [Presence of Selacien *Ptychodus* (*Pt. chappelli*) in the Upper Cretaceous of Ecuador (South America)]. *Bull. Mus. Natl. Hist. Nat., Paris* (1972). No. 74, pp. 91-94.
947. WETMORE L. L. (1906) Gold dredging in Ecuador. *Min. Mag. New York*, Vol. 13, pp. 385-391.
948. WHITE E. I. (1927) On a fossil Cyprinodont from Ecuador. *Ann. Mag. Nat. Hist. Ser. 9*, Vol. 20, pp. 519-522. [The first record of a fish from the freshwater Tertiary beds of the Loja Basin – see also 143 and 718].
949. WHITTAKER J. E. (1980) Revision of *Plummerita* Brönnimann (Foraminifera) and a new Maastrichtian species from Ecuador. *Bull. Br. Mus. Nat. Hist. (Geol.)*, Vol. 34, No. 4, pp. 287-297.
950. WHYMPER E. (1892) *Travels amongst the Great Andes of the Equator*. (London: Murray). *Supplementary appendix*. 1891 (London: Murray). [A fascinating general account of his travels and mountaineering achievements in Ecuador – see 133, 134 for details of the rock specimens collected].
951. WILLARD B. (1966) *The Harvey Bassler collection of Peruvian fossils*. (Bethlehem, Pennsylvania: Lehigh University) [Describes Jurassic and Cretaceous fauna and flora from the little-known Yaupi and Upano areas of southernmost Ecuador].
952. WILLIAMS C. T. (1947) The mining of the Mercedes orebody, Macuchi, Ecuador, South America. *Trans. Can. Inst. Min. Metall.*, Vol. 50, pp. 84-103.
953. WILLIAMS H. (1966) Geology of the Galápagos Islands. In Bowman, R. I. 1966.
954. WILLIAMS M. D. (1947) Informes geológicos y geofísicos de la International Ecuadorian Petroleum Co. Concesiones: 1. Daule-Guayas, 2. Minero, 3. Ecuapetrol-Manabí. [Geological and geophysical reports of the International Ecuadorian Petroleum Co. Concessions: 1. Daule-Guayas, 2. Minero, 3. Ecuapetrol-Manabí]. Unpublished report of the Dirección Minería y Petróleo, Ministerio Económico, Quito. [See remarks for 181].
955. WILLIAMS M. D. (1949) Depósitos terciarios continentales del valle del alto Amazonas. [Tertiary continental deposits of the valley of the upper Amazon]. *Soc. Geol. Perú, Vol. Jubilar*, Fasc. 5 pp. 1-13. [Contains an intriguing (?erroneous) reference to an Oligocene fauna in the supposed Maastrichtian Tena Formation. Also gives Peruvian names to certain Tertiary deposits in the Ecuadorian Oriente].
956. WILLIAMS D. L., VON HERZEN R. P., SCLATER J. G. and ANDERSON R. N. (1974) The Galápagos spreading centre: lithospheric cooling and hydrothermal circulation. *Geophys. J. R. Astron. Soc.*, Vol. 36, pp. 587-603.
957. WILSON J. S. (1886) Geological notes on the Pacific coast of Ecuador and on some evidences of the antiquity of Man in that region. *Q. J. Geol. Soc.*, Vol. 22, pp. 567-570.

- 958.** WILSON J. T. (1963) Evidence from islands on the spreading of ocean floors. *Nature, London*, Vol. 197, pp. 536-538.
- 959.** WISSE S. (VISSE IN ERROR) (1849) Étude sur les blocs erratiques des Andes de Quito. [A study of the erratic blocks of the Andes of Quito]. *C. R. Hebd. Séances Acad. Sci., Paris*, Vol. 28, pp. 303-307.
- 960.** WISSE S. (1853) Exploration du volcan de Sangai. *C. R. Hebd. Séances Acad. Sci., Paris*, Vol. 36, pp. 716-722.
- 961.** WISSE S. (1854) Le *Cuica* des Andes de l'Equateur. *Bull. Soc. Géol. Fr.* Ser. 2, Vol. 11, pp. 460-466.
- 962.** WISSE S. and GARCÍA MORENO G. (1846) Exploration du volcan Rucu Pichincha ... [Extract]. *C. R. Hebd Séances Acad. Sci, Paris*, Vol. 23, pp. 26-35.
- 963.** WOLF T. (1872) Über die Bodenbewegungen an der Küste von Manabí, nebst einigen Beiträgen zur geognostischen Kenntnis Ecuadors. [Concerning earth movements on the coast of Manabí, including some contributions to the geological knowledge of Ecuador]. *Z. Dtsch. Geol. Ges.*, Vol. 24, pp. 51-59.
- 964.** WOLF T. (1873a) Brief an Prof. Vom Rath [Letter to Professor Vom Rath]. *Verh. Naturhist. Ver. Preuss. Rheinlande*, Vol. 30, pp. 116-120.
- 965.** WOLF T. (1873b) Über ecuadorianische Vulkane [Concerning volcanoes in Ecuador]. *Z. Dtsch. Geol. Ges.*, Vol. 25, pp. 102-106.
- 966.** WOLF T. (1873c) *Crónica de los fenómenos volcánicos y terremotos en el Ecuador ... desde 1533 hasta 1797*. [Chronicle of the volcanic and earthquake phenomena in Ecuador ... from 1533 to 1797]. (Quito: Impresor Nacional). Reproduced by RATH G. VOM. *Verh. Naturhist. Ver. Preuss. Rheinlande*, 1873, Vol. 30, pp. 234-235.
- 967.** WOLF T. (1874-1878) Geognostische Mitteilungen aus Ecuador. [Geological information from Ecuador]. 1. Über das Vorkommen von Quarz-Andesit im Hochland von Quito. [Concerning the occurrence of quartz-andesite in the highland of Quito]. *Neues Jahrb. Mineral. Geol. Paläontol. Monatsch.*, 1874, pp. 376-385; 2. Geognostische Skizze der Provinz Guayaquil. [Geological sketch of the province of Guayaquil]. 1874, pp. 385-396; 3. Ein Schlammvulkan an der Westküste Ecuadors. [A mud volcano on the west coast of Ecuador]. 1874, pp. 396-398; 4. Kritische Zusammenstellung der in Ecuador stattgefundenen, Vulkan-Ausbrüche und Erdbeben seit der Zeit der Conquista. [Critical compilation of volcanic eruptions and earthquakes that have occurred in Ecuador since the time of the Conquistadors], 1875, pp. 152-170, 449-472, 561-584; 5. Der Cotopaxi und seine letzte Eruption am 26 Juni 1877. [Cotopaxi and its last eruption on 26th June 1877], 1878, pp. 113-167.
- 968.** WOLF T. (1876-1877) Geologie der Provinz Loja. *Z. Dtsch. Geol. Ges.*, Vol. 28, pp. 391-393; Geologie der Provinz Azuay. Vol. 29, pp. 197-198; Geologie der Provinz Esmeraldas. Vol. 29, pp. 412-416. [See remarks for 971].
- 969.** WOLF T. (1877) Der Ausbruch des Cotopaxi am 25 und 26 Juni 1877. [The eruption of Cotopaxi on the 25th and 26th of June 1877]. *Z. Dtsch. Geol. Ges.*, Vol. 29, pp. 594-597.
- 970.** WOLF T. (1878) *Memoria sobre el Cotopaxi y su última erupción*. [An account of Cotopaxi and its last eruption] (Guayaquil).
- 971.** WOLF T. (1879a) *Viajes científicos por la República del Ecuador*. 1. *Relación de un viaje geognóstico por la Provincia de Loja*. 2. *Relación de un viaje geognóstico por la Provincia de Azuay*. 3. *Memoria sobre la geografía y geología de la Provincia de Esmeraldas*. [Scientific journeys through the Republic of Ecuador. 1. Account of a geological trip through the Province of Loja. 2. Account of a geological trip through the Province of Azuay. 3. Record of the geography and geology of the Province of Esmeraldas]. (Guayaquil). [Basically the Spanish version of 968].
- 972.** WOLF T. (1879b) Bemerkungen über die Galápagos-Inseln, ihr Klima und ihre Vegetation, nach Beobachtungen in den Monaten August bis November 1875. [Remarks on the Galápagos Islands, their climate and vegetation, according to observations during the months of August to November 1875]. *Verh. Ges. Erdk. Berlin*, Vol. 6, pp. 245-256.
- 973.** WOLF T. (1879c) *Ein Besuch der Galápagos-Inseln*. [A visit to the Galápagos Islands]. (Heidelberg).
- 974.** WOLF T. (1892) *Geografía y geología del Ecuador*. [Geography and geology of Ecuador]. (Leipzig: Brockhaus). English translation by FLANAGAN J.F. 1932 (Toronto). [An important early work which for many years was the only book on the geology and geography of Ecuador].
- 975.** WOLF T. (1895) Die Galapagos-Inseln. [The Galápagos Islands]. *Verh. Ges. Erdk. Berlin*, Vol. 22, No. 4-5, pp. 246-265.
- 976.** WOLF W. A. (1912) Sketch of the geology of Ecuador. *Min. Sci. Press, San Francisco*, Vol. 105, pp. 110-111; *Min. Mag.*, 1912, Vol. 7, pp. 224-225. [Information abstracted from 974].
- 977.** WOLFF F. VON (1904a) Die älteren Gesteine der ecuadorianischen Ost-Cordillere sowie die des Azuay und eines Teiles der Cuenca-Mulde. [The older rocks of the eastern Cordillera of Ecuador, as well as of Azuay and part of the Cuenca basin]. Pp. 187-304. (Berlin: Asher). Spanish translation by MARTÍNEZ A. *An. Univ. Cent. Ecuador*, 1929, Vol. 32, pp. 13-24. [Included in Reiss, 1901-1904, III, pp. 187-304].
- 978.** WOLFF F. VON (1904b) Über das Alter der kristallinen Ost-Cordillere in Ecuador. [Concerning the age of the crystalline eastern Cordillera in Ecuador]. *Z. Dtsch. Geol. Ges.*, Vol. 56, pp. 94-97.
- 979.** WOLFF F. VON (1929) *Der Vulkanismus*. Vol. 2. (Stuttgart). [See pp. 372-373, 380-383, 410-412].
- 980.** WURM A. (1940a) Zur Geologie von Ecuador. [On the geology of Ecuador]. *Neues Jahrb. Mineral. Geol. Paläontol.*, Supplement, Vol. 83, Part B, pp. 443-478.
- 981.** WURM A. (1940b) Streifzüge eines Geologen durch Ecuador. [Excursions of a geologist through Ecuador]. *Nat. Volk.*, Vol. 70, pp. 329-337, 393-400.
- Y**
- 982.** YANTIS L. (1937) Informe sobre los depósitos de carbón de piedra de Biblián. [Report about the coal deposits of Biblián]. *Bol. Mens. Minist. Obras Publ.*, Vol. 2, No. 16-17, pp. 9-11. [See also 49, 110, 590, 591, 648, 681, 722, 804, 904].
- 983.** YANTIS L. (1942) Breve exposición sobre la geología del Ecuador, con respecto a los yacimientos de ciertos metales. [Brief account about the geology of Ecuador, with regard to the deposits of certain metals]. *Ist Congr. Panam. Ing. Minas Geol.*, Vol. 2, Geology Pt. 1, pp. 530-536.
- 984.** YOUNG A. (1902) Die Gesteine der ecuadorianischen Ost-Cordillere: Der Cotopaxi und die umgebenden Vulkanberge: Paschoa, Rumiñahui, Sincholagua und Quilindaña. [Rock types of the eastern Cordillera of Ecuador: Cotopaxi and the surrounding volcanoes: Paschoa, Rumiñahui, Sincholagua und Quilindaña]. Pp. 191-275 in Reiss and Stübel, 1896-1902. (Berlin: Asher).
- Z**
- 985.** ZEZZA F. (1974) Il Quaternario del corridoro interandino dell'Ecuador (Fossa di Latacunga-Ambato). [The Quaternary of the Interandean corridor of Ecuador (Latacunga-Ambato Graben)]. *Ist Geol., Attiv. Pavia. Univ.*, Vol. 24, pp. 120-130. [Includes photographs and a sketch map; English summary].
- ŽUJOVIĆ J. (1880) see JOUYOVITCH J. (1880) (see 466)
- 986.** ŽUJOVIĆ J. (1884) *Les roches des Cordillères*. (Paris: Lahure).
- 987.** ZÚÑIGA Y RIVERO F., PRADO A., VALDIVIA H., VELVARDE P. (1976) Hydrocarbon potential of Amazon Basins of Colombia, Ecuador and Perú. *Mem. Am. Assoc. Pet. Geol.*, No. 25, pp. 339-348.
- 988.** ZWICK B. F. (1944) Petroleum in Ecuador. *Mines Mag.*, Vol. 34, No. 10, pp. 540-543.
- 989.** ZWICK B. F. (1945) El Petróleo en el Ecuador. [Petroleum in Ecuador]. *Ecuador Pet.*, Vol. 1, No. 1.

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